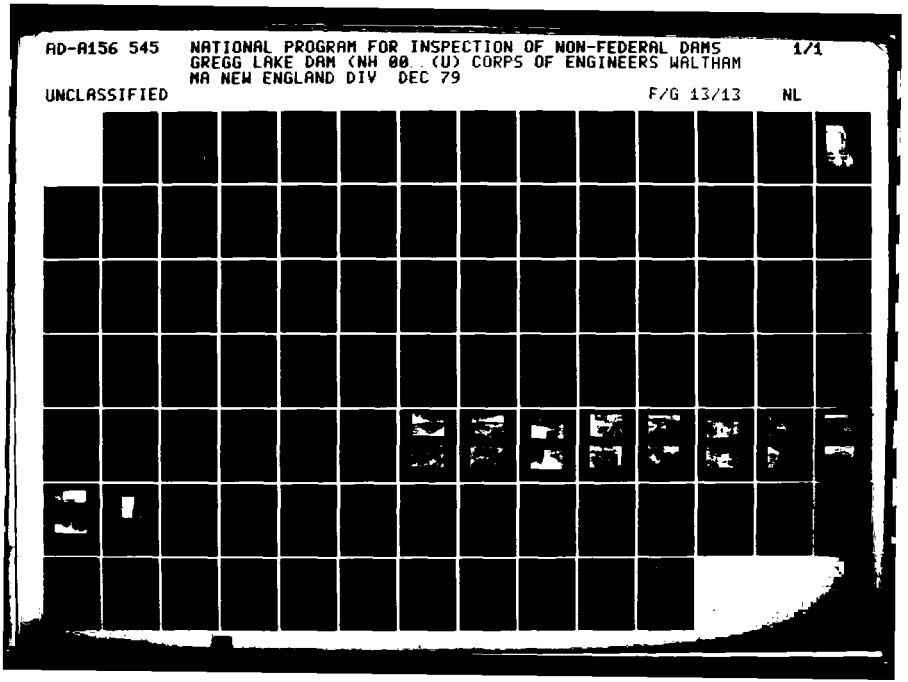
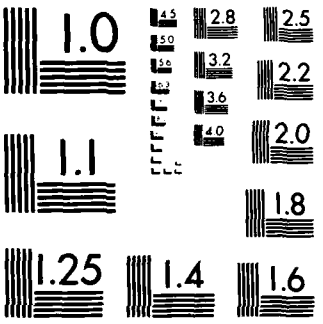
AD-A156 545 NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS 1/1
GREGG LAKE DAM (NH 00.. (U) CORPS OF ENGINEERS WALTHAM
MA NEW ENGLAND DIV DEC 79
UNCLASSIFIED F/G 13/13 NL



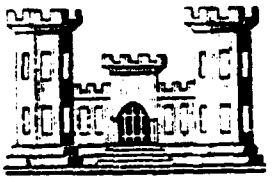


MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

CONTOOCOOK RIVER BASIN
ANTRIM, NEW HAMPSHIRE

GREGG LAKE DAM
NH-00056
NHWRB-9.03

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER NH 00056	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Gregg Lake Dam NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS		5. TYPE OF REPORT & PERIOD COVERED INSPECTION REPORT 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) U.S. ARMY CORPS OF ENGINEERS NEW ENGLAND DIVISION		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS DEPT. OF THE ARMY, CORPS OF ENGINEERS NEW ENGLAND DIVISION, NEDED 424 TRAPELO ROAD, WALTHAM, MA. 02254		12. REPORT DATE Decmeber 1979 13. NUMBER OF PAGES 45
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

APPROVAL FOR PUBLIC RELEASE: DISTRIBUTION UNLIMITED

17. DISTRIBUTION STATEMENT (of the abstract enter [illegible] in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

DAMS, INSPECTION, DAM SAFETY,

Contoocook River Basin
Antrim, New Hampshire
Gregg Lake Outlet

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The dam is a dry laid stone masonry and concrete structure with earthfill embankments. The dam is about 9 ft. high and about 210 ft. long with the earth embankments. The dam is assessed to be in fair condition. The size is intermediate with a significant hazard potential. Major concerns include apparent movement of the stone masonry and potential overtopping and erosion of low areas in the earth embankments.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

DISCLAIMER NOTICE

THIS DOCUMENT IS BEST QUALITY PRACTICABLE. THE COPY FURNISHED TO DTIC CONTAINED A SIGNIFICANT NUMBER OF PAGES WHICH DO NOT REPRODUCE LEGIBLY.

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF:
NEDED

AUG 26 1980

Honorable Hugh J. Gallen
Governor of the State of New Hampshire
State House
Concord, New Hampshire 03301

Dear Governor Gallen:

Inclosed is a copy of the Gregg Lake Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Water Resources Board, the cooperating agency for the State of New Hampshire. In addition, a copy of the report has also been furnished the owner, Carrol Johnson, Antrim Precinct, Antrim, New Hampshire 03440

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Water Resources Board for your cooperation in carrying out this program.

Sincerely,

MAX B. SCHEIDER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

CONTOOCOOK RIVER BASIN

ANTRIM, NEW HAMPSHIRE

GREGG LAKE DAM

NH-00056

NHWRB-9.03

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM

PHASE I INSPECTION REPORT

NH-00056
NHWRB-9.03

GREGG LAKE DAM

ANTRIM, NEW HAMPSHIRE

GREGG LAKE OUTLET

December 4, 1979 (Date of Field Inspection)

BRIEF ASSESSMENT

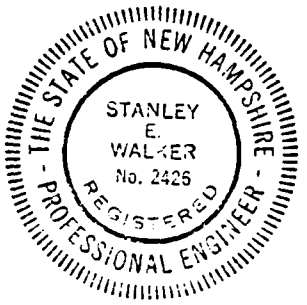
The Gregg Lake Dam is a dry-laid stone masonry and concrete structure with earthfill embankments. The dam is approximately 9 feet high, and about 210 feet long including earth embankments. The dam has three stop log controlled spillways totaling approximately 21 feet in length, a low level gated outlet, and a sluice gate outlet.

Based on the visual inspection, the Gregg Lake Dam is assessed to be in fair condition. Major concerns regarding the safety of the dam include apparent movement of the stone masonry and potential overtopping and erosion of low areas in the earth embankments. Based on Corps of Engineers guidelines, the dam is classified as an intermediate size dam having a significant hazard potential.

Based on the Corps of Engineers guidelines, the dam is classified as an intermediate size dam having a significant hazard potential and should have a test flood in the range of the one-half Probable Maximum Flood (1/2 PMF) to the Probable Maximum Flood (PMF). A spillway test flood equal to one-half the PMF was chosen to assess the spillway capacity. This is the maximum flood condition which could reasonably be expected during the life of the structure. The test flood peak inflow to Gregg Lake was computed to be 4950CFS. Due to the effect of surcharge storage in the lake, the routed test flood outflow was estimated to be 3,000 cfs. The spillway will pass 30 cfs or about one percent of the test flood without overtopping. During the test flood, water would overtop the right embankment by about 3.0 feet and the left embankment by about 3.3 feet, at the lowest location.

The recommendations and remedial measures presented in Section 7 and outlined below should be implemented within one year of receipt of

this report by the owner. The following should be evaluated by a qualified registered engineer: 1) the need for increased discharge capacity; 2) rehabilitation of the stone masonry in the area of apparent movement; 3) provide design to raise embankment to prevent overtopping of the dam and erosion protection of low areas in the earth embankment; 4) provide means for the removal of trees and their root systems on the downstream slope of the right embankment and upstream slope of the left embankment. Remedial measures include 1) removal of trees, brush, and loose rock overhanging the downstream spillway and sluice gate channels; 2) repair of concrete surfaces of the dam where spalling and cracking has occurred; 3) prohibit use of the dam embankments as a swimming beach or public landing unless adequate protection of the surfaces is provided; 4) provide around-the-clock surveillance during periods of anticipated high runoff; and 5) have inspections of the dam made annually by a qualified registered engineer.



EDWARD C. JORDAN CO., INC.

Stanley E. Walker, P.E.
Project Officer

This Phase I Inspection Report on Gregg Lake Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

CARNEY M. TERZIAN, MEMBER
Design Branch
Engineering Division

RICHARD DIBUONO, MEMBER
Water Control Branch
Engineering Division

ARAMAST MAHTESIAN, CHAIRMAN
Geotechnical Engineering Branch
Engineering Division

APPROVAL RECOMMENDED:

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general conditon of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environments of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonable possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

TABLE OF CONTENTS

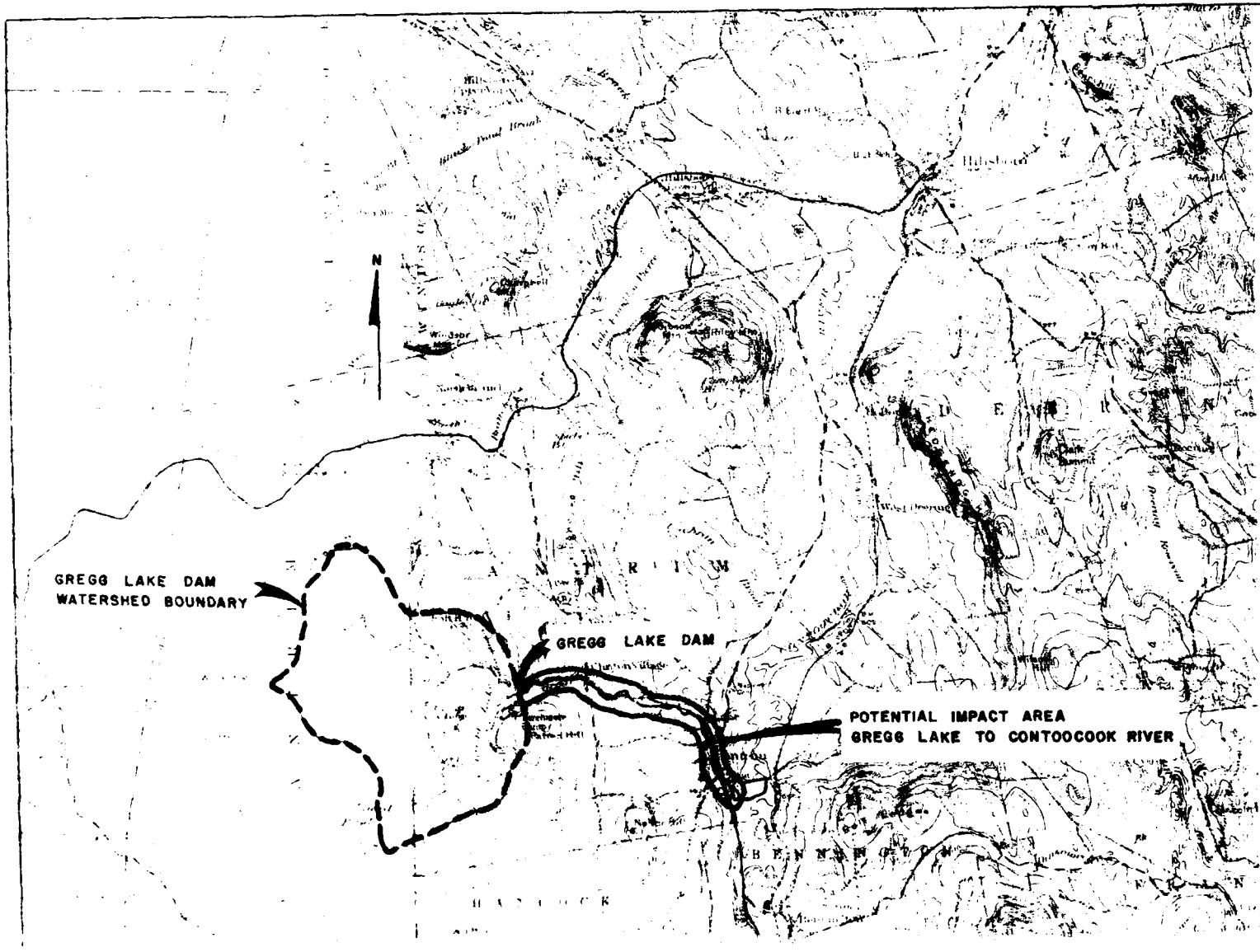
TABLE OF CONTENTS (Continued)

SECTION 6 - STRUCTURAL STABILITY

SECTION 7 - ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

APPENDICES

OVERVIEW



U.S. GEOLOGICAL SURVEY MAP

LOVELL MTN., N.H. QUADRANGLE
HILLSBORO, N.H. QUADRANGLE

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

GREGG LAKE DAM

LOCATION & DRAINAGE AREA MAP

PHASE I INSPECTION REPORT

GREGG LAKE DAM

SECTION 1

PROJECT INFORMATION

1.1 GENERAL

a. Authority. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Edward C. Jordan Co., Inc. has been retained by the New England Division to inspect and report on selected dams in the states of Maine and New Hampshire. Authorization and notice to proceed were issued to Edward C. Jordan Co., Inc. under a letter of December 1, 1978 from Max B. Scheider, Colonel, Corps of Engineers. Contract No. DACW33-79-C-0017 has been assigned by the Corps of Engineers for this work.

b. Purpose

(1) To perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.

(2) To encourage and prepare the states to initiate effective dam safety programs for non-Federal dams.

(3) To update, verify and complete the National Inventory of Dams.

1.2 DESCRIPTION OF PROJECT

a. Location. The Gregg Lake Dam is located on Great Brook, which is a tributary to the Contoocook River, at the outlet of Gregg Lake in the town of Antrim, New Hampshire. The dam is located on the U.S.G.S. Hillsboro, N.H. Quadrangle at the spherical coordiantes of N 43¼-02.3' latitude, W71°-58.7' longitude. The first downstream hazards are residences in Clinton Village, which is about 0.5 miles downstream of the dam.

b. Description of Dam and Appurtenances. The Gregg Lake Dam is a dry-laid stone masonry and concrete structure with earthfill embankments. The dam is approximately 9 feet high, and about 210 feet long including earth embankments. The dam has three stop log controlled spillways totaling approximately 21 feet in length, a low level gated outlet, and a sluice gate outlet.

c. Size Classification. The Gregg Lake Dam is classified as an intermediate size dam. It has a storage capacity of about 1300 acre-feet and a height of 9 feet. According to the Corps of Engineers "Recommended Guidelines for Safety Inspection of Dams," a dam with storage capacity greater than 1000 acre-feet but less than 50,000 acre-feet or a height greater than 40 feet but less than 100 feet is classified as an intermediate size dam.

d. Hazard Classification. According to the Corps of Engineers guidelines, Gregg Lake Dam is Classified as having a significant hazard potential because loss of life would be low and economic loss could be appreciable. The peak flow from a hypothetical failure of the dam was computed to be 1,160 cfs based on estimating procedures provided by the Corps of Engineers. The most damaging failure would most likely occur through the section of dam between the left spillway and the gate at the center of the dam. The flow from failure could cause damage to as many as 9 to 12 houses along Great Brook. Flooding depths at residences would be minimal, probably one foot or less. Therefore, loss of life would likely be very low.

e. Ownership.

Current Owner:	Antrim Precinct Antrim, New Hampshire 03440
	Contact: Carroll Johnson (603) 588-2293
Previous Owner: (prior	Clinton and South Antrim Water Co.
	to 1965)
	Originally owned by several mills with each mill having a share.

f. Operator.

Designated by Owner

g. Purpose of Dam. The dam was originally used as water power dam for mills downstream and is presently being used for public water supply storage and for recreational purposes.

h. Design and Construction History. There were no design or construction data disclosed. Information on file at the New Hampshire Water Resources Board office in Concord, New Hampshire indicates that the dam was built in 1908 and rebuilt about eight years later. A member of the Antrim Precinct said that the concrete buttresses were added about 1948 and a new gate was installed about 1966 or 1967.

i. Normal Operating Procedures. The Gregg Lake Dam has no reported formal operating and maintenance program.

1.3 PERTINENT DATA

a. Drainage Area. The drainage area above Gregg Lake Dam is about 4.7 square miles. The watershed is primarily forested with moderate to steep slopes. Gregg Lake's normal water surface elevation is about 1,053, and the highest ground elevation on the drainage divide is about 1,900. There is some development, primarily cottages, on the shore of Gregg Lake.

b. Discharge at Damsite. Releases from Gregg Lake Dam can be made at the three stop log controlled overflow spillways and two gated outlets. The following pertinent discharges at the dam were estimated assuming the water surface elevation to be at the top of the dam (elevation 1,053.4).

(1) Gated outlet works capacity - 11 cfs at sluice gate (at gatehouse), 27 cfs at low level gate.

(2) Maximum historical flood discharge is unknown. However, the September 1938 flood water surface elevation is reported to have risen to about the top of the dam, and the discharge is estimated to have been 230 cfs.

(3) Upgated spillway capacity with water surface at top of dam elev. 1,053.4 with stop logs removed (see appendix "B" for identification of spillways) - 30 cfs

Spillway #1	12 cfs
Spillway #2	12 cfs
Spillway #3	6 cfs

(4) Upgated spillway capacity with water surface at test flood evelation 610 cfs @ elev. 1,057.4.

(5) Gated spillway capacity at normal pool elevation 1,053.0. Not applicable.

(6) Gated spillway capacity at test flood elevation 1,057.4. Not applicable.

(7) Total spillway capacity at test flood elevation 610 cfs @ elev. 1,057.4.

(8) Total project discharge at test flood (1/2 PMF)-3,000 cfs

c. Elevation. The survey datum was adjusted to mean sea level (MSL) datum based on the assumption that the right spillway crest is approximately equal to normal water surface elevation of 1053 (MSL) as shown on the Hillsboro, NH, U.S. Geological Survey quadrangle. MSL datum coincides with the National Geologic Vertical Datum (NGVD) throughout this report. The following elevations above NGVD are approximate only.

ITEM	APPROXIMATE ELEVATION (feet above NGVD)
Streambed at centerline of dam	1045.4
Maximum tailwater	Unknown
Recreation pool	1053.0
Full flood control pool	N/A
Spillway crest-spillways #1&2	1052.6
-spillway #3	1053.0
Top of dam	1053.4
Test flood (1/2 PMF) pool	1057.4

d. Reservoir Reach.

ITEM	LENGTH (MILES)
Spillway Crest	1.1
Top of Dam	1.1

e. Reservoir Storage Capacity.

ITEM	STORAGE (ACRE-FEET)
Spillway Crest (elev. 1053.0)	1000
Top of Dam (Elev. 1054.4)	1300
1/2 PMF Pool	1780

f. Reservoir Surface Area.

ITEM	ACRES
Spillway Crest (Elev. 1052.6)	212
Top of Dam (Elev. 1054.4)	220
1/2 PMF Pool	250

g. Dam.

Type - Dry-laid stone masonry dam with concrete cap forming the spillway crest and concrete abutments, buttresses, and training walls upstream, situated between earthfill embankments.

Length - The length between concrete abutments at top of dam is approximately 80 feet. The left and right embankments are approximately 50 and 80 feet long, respectively.

Height - 9 feet from top of dam to streambed.

Top Width - Varies (See plan and cross-sections in Appendix B-1).

Side Slopes - Not applicable.

Zoning - Unknown.

Impervious Core - Unknown

Cutoff - Stone masonry placed on stream bed

Grout Curtain - Unknown

h. Diversion and Regulating Tunnel. Not applicable.

i. Spillway.

Type - Stop log controlled, overfall (see appendix B for identification of spillways).

Length - Spillway #1 6.5 feet
Spillway #2 6.5 feet
Spillway #3 8.2 feet

Crest Elevation feet (MSL)
Spillway #1 1052.6
Spillway #2 1052.6
Spillway #3 1053.0

Gates - Ungated.

Great Brook immediately below the dam is composed of two channels which consist of ledge and cobbles as shown in photos No. 2 and 3. The two channels join about 200 feet downstream of the dam. The banks of both channels are forested. Great Brook joins the Contoocook River, in Antrim, about 3 1/2 miles below Gregg Lake Dam.

j. Regulating Outlets.

Inverts: Sluice gate invert (upstream) - 1048.8 (MSL)
Sluice gate outlet (downstream) - 1035.2 MSL
Low level gated outlet - 1046.8± MSL

Size: Sluice gate outlets - 16-inch diameter
Low level gated outlet - 20-inch diameter

Description - Sluice gate-Reportedly a 16-inch diameter bronze gate.
Low level gate-18-inch x 18-inch timber gate and platform.

Control Mechanism - Sluice gate-manually operated wheel inside gate house structure (see photos No. 8 and 15).

Low level gate-Manually operated gear driven mechanism located on the crest of the spillway. The low level gate operating mechanism is inaccessible during flood conditions.

SECTION 2

ENGINEERING DATA

2.1 DESIGN

No design data were available for the Gregg Lake Dam.

2.2 CONSTRUCTION

No engineering data were available regarding construction of the Gregg Lake Dam.

2.3 OPERATION

No engineering operational data were available.

2.4 EVALUATION

a. Availability. There are no engineering data or plans available that would be useful in evaluating the integrity of Gregg Lake Dam.

b. Adequacy. The lack of engineering data did not allow for a definitive review. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data, but is based primarily on visual inspection and engineering judgment.

c. Validity. Not applicable.

SECTION 3

VISUAL INSPECTION

3.1 FINDINGS

a. General. The Gregg Lake Dam consists of a dry-laid stone masonry and concrete structure situated between earth embankments. The dam appears to be founded on bedrock and is used to control the water level of Gregg Lake which is being used for water supply storage and recreational purposes. Additional information describing the configuration of the dam and detailed notes of the visual inspection are included in Appendix A (Visual Inspection Checklist and Supplementary Inspection Notes), Appendix B (Plan, Profile, and Cross-Sections of the Structure), and Appendix C (Photographs).

b. Dam

(1) Structural - From right to left the dam consists of an earth embankment in which a sluice gate is located; a concrete faced gravity dry-laid stone masonry structure containing a low level gated outlet and three stop log controlled spillways, and an earth embankment. The visual inspection indicated the dam to be in fair condition. The visual inspection resulted in the following major findings:

(a) The upstream face of the right embankment is a concrete retaining wall as shown in photos No. 5 and 6. The concrete visible at the time of the inspection was in good condition. The upstream face of the left embankment is covered with brush, weeds and trees and appears to have some riprap that extends from the spillway 40 feet upstream along the embankment.

(b) A beach and/or boat landing is located about 60 to 80 feet upstream of the left spillway abutment. The ground surface in this area is at a lower elevation than the top of the adjacent left embankment.

(c) The top of the right embankment is grass covered except that portion which is a paved public road as shown in photos No. 6 and 10. The top of the upstream left embankment is also grass covered.

(d) The downstream face of the right embankment is a dry-laid stone masonry retaining wall which has been partially covered with earth fill (see photo No. 8). The wall is reported to have been a portion of the foundation for a mill that at one time abutted the downstream face of the embankment. Remnants of the mill foundation walls are located immediately downstream of the embankment. The wall appears to be in fair to good condition as shown in photo No. 4. Numerous trees up to 24 inches in diameter are located on the slope of the earth fill and along the top of the retaining wall.

(e) The downstream slope of the left embankment is generally covered with grass. Some small trees were observed along the downstream toe of the embankment.

(f) Unusual seepage, leakage, and/or structural movements of the embankments were not observed.

(g) Some minor seepage was observed along the bedrock surface in the vicinity of a shelter structure located downstream of the left embankment.

(h) The spillway and center portion of the dam consists of a dry-laid stone masonry structure that is capped with concrete along the crest and upstream face. The structure appears to be founded on bedrock. The abutments of the dam are generally bedrock except for the top one to two feet which consist of soil from the earth embankments. The spillway consists of three individually controlled stop log spillways (see Appendix B for identification of the spillways). Spillways No. 1 and 2 are located at the left abutment of the dam and have stop log openings about 6.5 feet long, and extend about 1.3 feet below the crest of the dam. Spillway No. 3 located at the right abutment of the dam has a stop log opening about 8.2 feet long and extends about 1.4 feet below the dam crest. Stop logs were not in at the time of the visual inspection. The water level was about 0.45 feet below the crest of spillway No. 3.

The concrete of the upstream face of the dam, above the lake water level, appeared to be in good condition.

The crest of the dam is about two feet above the downstream concrete cap as shown in Photo No. 9. Concrete buttresses, apparently designed to provide support of the spillway weir, are located on the concrete cap as shown in Photo No. 9. The concrete cap was in fair to good condition except in the vicinity of the low level gated outlet, the buttress to the left of the low level gated outlet where numerous cracks were observed, (see Photo No. 13), and where separation of the concrete cap from the upstream face of the spillway was observed between the low level gated outlet and the left spillway abutment (see Photo No. 10.)

The downstream face of the dam is a dry-laid stone masonry wall and appears to be in good condition to the right of the low level gated outlet and in fair condition to the left of the low level gated outlet. From the low level gated outlet to the left spillway abutment the masonry wall is tilted downstream. The top of the wall overhangs the toe of the wall by about one foot as shown in Photo No. 14. Separation of the concrete cap from the upstream face of the spillway was observed in this area, indicating that some movements of the spillway have occurred (see Photo No. 10). Heavy leakage was observed along the toe of the dry-laid masonry wall to the left of the low level gated outlet. Minor leakage at the toe of the wall was observed to the right of the low level gated outlet as evidenced by the presence of ice, (Photo No. 11).

Numerous small tree stumps up to about two inches in diameter were observed at the intersection of the top of the stone masonry wall and concrete cap.

Low Level Gated Outlet. The low level gated outlet is located at about the center of the dam, and is operated by a gear driven mechanism located on the crest of the dam. The low level gate was not opened during the visual inspection, however, it is reported to be operational. Water, apparently due to leakage, was observed flowing from the opening, about 18 inches square, in the downstream face of the masonry spillway wall as shown in Photo No. 11.

Sluice Gate and Structure. The sluice gate, used to control the level of the lake, is located at about the middle of the right embankment. The sluice gate is reported to have supplied water to the mill that had abutted the downstream face of the right embankment. The sluice gate is 16 inches in diameter and is adjusted by a manually operated wheel located in a wood framed gatehouse on the crest of the embankment, as shown in Photos No. 6 and 17. The gatehouse appears to be in good condition. The gate was operated during the visual inspection and appeared to operate satisfactorily. The sluice gate discharge channel passes through the abandoned mill site through which it is bounded by stone masonry walls. Beyond the abandoned mill site the discharge channel is the natural river bed which is mostly exposed bedrock.

(2) Hydraulics - At the time of the visual inspection, the lake level was estimated to be Elevation 1,052.55 (MSL). The sluice gate in the right embankment was operated by the supervisor of the dam. The discharge from this gate flowed in a channel through an abandoned mill site and back to the main brook channel about 200 feet downstream from the dam. The low level gate, not operated during the visual inspection, was observed to be flowing water.

c. Appurtenant Structures. Not applicable

d. Reservoir Area. The reservoir consists of Gregg Lake. The reservoir area at elevation 1,053 is 212 acres. There are many cottages on the shore of Gregg Lake.

e. Downstream Channel. Great Brook immediately below the dam is composed of two channels which consist of ledge and cobbles as shown in Photos No. 2 and 3. The two channels join about 200 feet downstream of the dam. The banks of both channels are forested. Great Brook joins the Contoocook River about 3 1/2 miles below Gregg Lake Dam. The downstream channel is generally clear of debris and obstructions except for a road bridge which is located about 40 feet downstream of the dam. The bridge does not appear to cause submergence of the dam (see calculation Appendix D).

3.2 EVALUATION

Based on the visual inspection, the dam appears to be in fair condition. The observed separation of the concrete from the upstream face of the spillway indicates some movements of the spillway structure have occurred. The left embankment requires regrading and maintenance. As outlined in Section 7, rehabilitative construction and maintenence is necessary to enhance the long-term safety of the structure.

SECTION 4

OPERATING PROCEDURES

4.1 PROCEDURES

No written operating procedures were disclosed. Gregg Lake Dam controls the water surface elevation of Gregg Lake. Under normal conditions the sluice gate is used to control lake water levels. The low level gate is used during periods of high flow.

4.2 MAINTENANCE OF DAM

No maintenance program was disclosed. It appears that little or no maintenance of the dam has been performed in recent years.

4.3 MAINTENANCE OF OPERATING FACILITIES

The gated outlet works appears to be in fair condition. The gates could not be observed during the field inspection.

4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT

No warning system is known to be in effect. A member of the Antrim Precinct reportedly visits the dam site weekly during the spring and other times of high flow.

4.5 EVALUATION

Current maintenance and operating procedures are inadequate. No established surveillance or flood warning system is in effect.

SECTION 5

HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. General. The Gregg Lake Dam is a dry-laid stone masonry dam with concrete capped spillways and dam crest. The dam has three stop log controlled spillways and two outlet gates, a 16-inch diameter pipe outlet and a 20-inch diameter pipe outlet.

b. Design Data. No original hydrologic or hydraulic design data were available for review.

c. Experience Data. Reportedly, the dam has never been overtopped, although in the September 1938 flood the dam was nearly overtopped. During this flood the lake water surface went from a level 30 inches below spillway crest to the top of the dam in less than 36 hours. According to the U.S. Geological Survey Water Supply Paper 1671, the September 1938 flood is the flood of record on the Contoocook River in North Village, N.H. A peak discharge of 10,400 cfs was recorded on September 21, 1938.

d. Visual Observations. Flow from Gregg Lake is discharged by three stop log controlled spillways and two outlet gates. The sluice gate was observed to be operable, and the low level gate was reported to be operable. The low level gate is a 20-inch diameter pipe which discharges below the center of the dam. The sluice gate is a 16-inch diameter pipe which runs from a gatehouse, on the right embankment, to a secondary channel which joins the main stem of Great Brook about 200 feet downstream of the dam. At the time of the visual inspection, the lake level was estimated to be at elevation 1052.55 ft MSL, less than one inch below the left stop log controlled spillways.

e. Test Flood Analysis. Gregg Lake Dam is classified as having a significant downstream hazard potential. According to Corps of Engineers, "Recommended Guidelines for Safety Inspection of Dams", the test flood should be in the range of one-half Probable Maximum Flood (1/2 PMF) to Probable Maximum Flood (PMF). A spillway test flood equal to the 1/2 PMF was chosen to assess the spillway adequacy under the maximum flood conditions which could reasonably be expected during the life of the structure. The drainage area above Gregg Lake Dam is approximately 4.7 square miles and is characterized as rolling to mountainous.

Using the Corps of Engineers' guidance curves for estimating probable maximum discharges, the test flood peak inflow to Gregg Lake was computed to be 4950 cfs. Due to the effect of surcharge storage in the lake, the routed test flood peak outflow at the dam is approximately 3000 cfs. The spillways are capable of discharging about 30 cfs or approximately one percent of the test flood without overtopping the right abutment. The test flood would overtop the right abutment by 4.0 feet and the left abutment by 3.5 feet.

f. Dam Failure Analysis. To determine the hazard classification for Gregg Lake Dam, the potential impact of failure of the dam when the lake water surface elevation is level with the top of the dam was assessed. The failure analysis relied upon the Corps of Engineers "rule of thumb" guidelines. The hazard potential was determined by calculating downstream dam failure hydrographs depicting conditions which might occur downstream due to a breach of dam between spillway No. 2 and the outlet gate at the center of the dam. Although the erosion type failure of the left embankment may be more likely than a breach near the No. 2 spillway, a failure in the left embankment would not likely cause as much damage as one near the No. 2 spillway because bedrock is very shallow in the embankment.

The flood peak at the dam from failure was computed to be 980 cfs. It would take the lake about 1 1/2 days to empty. The postulated failure flow represents a 950 cfs increase over the prefailure flow. The prefailure flow would be contained within the brook channel. The bridge immediately downstream of the dam would be overtopped by about 1 1/2 feet. About 0.7 of a mile downstream of Gregg Lake Dam, the peak flow from failure would produce flood depths of about one foot near three or four homes. About 1.2 miles downstream of the dam flood depths would reach levels about one foot above the road, flooding about three houses. Further downstream, two to four houses may be affected by minor flooding before Great Brook joins the Contoocook River. The river would absorb the failure peak flow from Great Brook and substantially eliminate additional significant downstream flooding. In all, nine to twelve houses could be affected along Great Brook by the failure of Gregg Lake Dam. Danger of the loss of life may be considered to be minimal.

SECTION 6

STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations. Based on visual observations, the Gregg Lake Dam appeared to be in fair condition. Movements of the spillway have occurred as evidenced by the one to two inch gaps between the concrete cap and upstream face of the dam. Cracks in the concrete cap of the dam were observed near the low level gated outlet and at the buttress to the left of the low level gated outlet. The stone masonry downstream face of the spillway is tilted downstream to the extent that the top of the wall overhangs the toe by about one foot.

Numerous trees up to 24 inches in diameter are located on the downstream slope of the right embankment and upstream slope of the left embankment. The root system of these trees could cause deterioration of the stone masonry walls and/or provide channels for water to pass through the embankments. The ground surface at the beach or public landing located near the left embankment is about 1.6 feet below the crest elevation of the left embankment. This area is susceptible to overtopping and erosion and is therefore an area of concern.

b. Design and Construction Data. The available information indicates the Gregg Lake Dam was built in 1908 and rebuilt, for reasons unknown, in 1916. Data concerning the original embankment on spillway design is not available. However, the State of New Hampshire Water Resources Board provided a sketch of the dam showing a plan view and a cross-section through the spillway that was dated August 24, 1939. It is not known if the cross-section of the sketch is based on original design data or by estimated dimensions. Based on the available information and the visual inspection, the dam appears to be founded on bedrock.

c. Operating Records. Previous inspections were made in 1925, and 1965 (copies of these inspection reports are included in appendix B). In both reports the dam was reported to be in good condition. Some maintenance and remedial repairs were recommended in the 1965 report.

d. Post-Construction Changes. Details of post-construction changes are not known, although the 1965 inspection report did recommend some maintenance and remedial work.

e. Seismic Stability. The dam is located in Seismic Zone two and in accordance with Phase I guidelines does not warrant seismic analyses.

SECTION 7

ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Condition. The visual inspection indicates that the Gregg Lake Dam is in fair condition. Major concerns relative to the physical condition of the dam are the causes of apparent structural movements of the spillway and the potential overtopping and erosion of low areas in the earth embankments.

b. Adequacy of Information. The information available is such that assessment of the condition of the dam must be based primarily on the visual inspection, the past operational performance of the dam, and engineering judgement and is considered adequate for a Phase I level evaluation.

c. Urgency. The recommendations and remedial measures outlined in Section 7.2 and 7.3 should be implemented within 12 months after receipt of this report by the owner.

d. Need for Additional Investigation. Additional investigation is not considered necessary for the current assessment.

7.2 RECOMMENDATIONS

The owner should engage a qualified registered engineer within 12 months to provide the following services:

(1) Analyze the need for increased discharge capacity.

(2) Evaluate the spillway structure for the purpose of determining the cause of apparent movements observed at the time of the visual inspection and provide recommendations for rehabilitation measures.

(3) Provide design to raise embankments to prevent overtopping of the dam and erosion of low areas in the earth embankment.

(4) Provide means for the removal of trees and their root systems on the downstream slope of the right embankment and upstream slope of the left embankment.

7.3 REMEDIAL MEASURES

A program of regular inspection and maintenance of the dam should be implemented and recorded. The following specific maintenance and operating procedures should be implemented within one year of recipt of this report by the owner.

(1) Remove trees, and brush, and loose rock overhanging the downstream spillway and sluice gate channels.

(2) Repair surfaces of dam where cracking and spalling of the concrete has occurred.

(3) Prohibit the use of the dam embankments as a beach or public landing unless adequate protection of the surfaces is provided.

(4) Provide around-the-clock surveillance during periods of anticipated high runoff.

(5) Have inspections of the dam made annually by a qualified registered engineer.

7.4 ALTERNATIVES

Not applicable.

APPENDIX A

VISUAL INSPECTION CHECKLIST

AND

SUPPLEMENTARY INSPECTION NOTES

VISUAL INSPECTION CHECK LIST
PARTY ORGANIZATION

PROJECT Gregg Lake Dam

DATE Dec. 4, 1979

TIME 1000 - 1300

WEATHER Cloudy, 30's

W.S.ELEV. 1052.2± U.S. DN.S

PARTY:

1. Scott Decker
2. John Kimble
3. William Fisher
4. Arthur Stackhouse
5. Gary Shearer
6.
7.
8.
9.
10.

	PROJECT FEATURE	INSPECTED BY	REMARKS
1.	Geotechnical	Fisher	
2.	Hydraulics/Hydrology	Shearer	
3.	Civil	Decker	
4.	Structural	Fisher, Decker	
5.	Survey	Kimble, Stackhouse	
6.	Photographs	Decker	
7.			
8.	Review inspection made on Dec. 21, 1979 by C.H. Horstmann and S.E.		
9.	Walker. Other than the lake being frozen over, no significant		
10.	different conditions were observed.		

PERIODIC INSPECTION CHECK LIST

PROJECT Gregg Lake Dam DATE Dec. 4, 1979

PROJECT FEATURE Dike Embankment NAME Fisher

DISCIPLINE Geotechnical NAME

AREA EVALUATED	CONDITION
DIKE EMBANKMENT	
Crest Elevation	
Current Pool Elevation	
Maximum Impoundment to Date	
Surface Cracks	None apparent
Pavement Condition	Right embankment consist of paved White Birch Pt. Road and grass. Left embankment is grass and tree covered.
Movement or Settlement of Crest	None observed
Lateral Movement	None observed
Vertical Alignment	Appears okay
Horizontal Alignment	Appears okay
Condition at Abutment and at Concrete Structures	Appears good
Indications of Movement of Structural Items on Slopes	None observed
Trespassing on Slopes	A boat landing or beach exists upstream of the left embankment

AREA EVALUATED	CONDITION
DIKE EMBANKMENT (cont.)	
Sloughing or Erosion of Slopes or Abutments	Loss of soil at boat landing or beach has caused the ground surface elevation to be lower than the crest of the left embankment
Rock Slope Protection - Riprap Failures	None observed on right embankment. Some riprap observed on the left embankment from the abutment with the spillway to a point about 40 feet upstream
Unusual Movement or Cracking at or near Toes	None observed
Unusual Embankment or Downstream Seepage	Some minor seepage along bedrock surface in vicinity of shelter structure downstream of left embankment
Piping or Boils	None observed
Foundation Drainage Features	None observed
Toe Drains	A small diameter pipe was discharging some water from beneath the shelter's slab-on-grade floor
Instrumentation System	None

PERIODIC INSPECTION CHECK LIST

PROJECT Gregg Lake Dam DATE Dec. 4, 1979

PROJECT FEATURE Intake Channel Structure NAME Fisher, Decker

DISCIPLINE Structural, Geotechnical Hydrology/Hydraulics NAME Shearer

AREA EVALUATED	CONDITION
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	
a. Approach Channel	
Slope Conditions	Not observed because of water elevation
Bottom Conditions	Not observed because of water elevation
Rock Slides or Falls	None observed
Log Boom	None observed
Debris	None observed
Condition of Concrete Lining	Above the water surface it appears to be in good condition, except at the low level gate where it appears to be in fair condition.
Drains or Weep Holes	None observed
b. Intake Structure	
Condition of Concrete	Appears to be in good condition
Stop Logs and Slots	Not applicable

PERIODIC INSPECTION CHECK LIST

PROJECT Gregg Lake Dam DATE Dec. 4, 1979

PROJECT FEATURE Control Tower NAME Fisher, Decker

DISCIPLINE Structural, Geotechnical Hydrology/Hydraulics NAME Shearer

AREA EVALUATED	CONDITION
OUTLET WORKS - CONTROL TOWER	
a. Concrete and Structural	Control tower is a wood framed structure founded on the concrete intake. Outside of tower is covered with sheet metal.
General Condition	Good condition
Condition of Joints	Good
Spalling	None observed
Visible Reinforcing	None observed
Rusting or Staining of Concrete	None observed
Any Seepage or Efflorescence	None observed
Joint Alignment	Good
Unusual Seepage or Leaks in Gate Chamber	N/A
Cracks	None observed
Rusting or Corrosion of Steel	Valve stem only
b. Mechanical and Electrical	
Air Vents	N/A
Float Wells	N/A
Crane Hoist	N/A

AREA EVALUATED	CONDITION
CONTROL TOWER (cont.)	
Elevator	N/A
Hydraulic System	N/A
Service Gates	Good condition-gate was operated during inspection
Emergency Gates	N/A
Lightning Protection System	None observed
Emergency Power System	None observed
Wiring and Lighting System in Gate Chamber	N/A

PERIODIC INSPECTION CHECK LIST

PROJECT Gregg Lake Dam DATE Dec. 4, 1979

PROJECT FEATURE Transition & Conduit NAME Fisher, Decker

DISCIPLINE Structural, Geotechnical Hydrology/Hydraulics NAME Shearer

AREA EVALUATED	CONDITION
OUTLET WORKS - TRANSITION AND CONDUIT	Not Observable
General Condition of Masonry	
Rust of Staining on Masonry	
Spalling	
Erosion or Cavitation	
Cracking	
Alignment of Monoliths	
Alignment of Joints	
Numbering of Monoliths	

PERIODIC INSPECTION CHECK LIST

PROJECT Gregg Lake Dam DATE Dec. 4, 1979

PROJECT FEATURE Outlet Structure/Channel NAME Fisher, Decker

DISCIPLINE Structural Geotechnical Hydrology/Hydraulics NAME Shearer

AREA EVALUATED	CONDITION
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	
General Condition of Masonry	Service gate outlet is located in the face of the stone masonry wall on the downstream face of the right embankment.
Rust or Staining	None observed
Spalling	N/A
Erosion or Cavitation	None observed
Visible Reinforcing	N/A
Any Seepage or Efflorescence	None observed
Condition at Joints	Good
Drain holes	None observed
Channel	
Loose Rock or Trees Overhanging Channel	Some rocks in the stone masonry wall are loose. Numerous trees to about 24 inches in diameter are overhanging the channel.
Condition of Discharge Channel	The discharge channel passes through the foundation ruins of an abandoned mill site. The channel contains some trees and rock which has fallen from the channel banks.

PERIODIC INSPECTION CHECK LIST

PROJECT Gregg Lake Dam DATE Dec. 4, 1979

PROJECT FEATURE Spillway NAME Fisher, Decker

DISCIPLINE Structural Geotechnical Hydrology/Hydraulics NAME Shearer

AREA EVALUATED	CONDITION
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel	
General Condition	Appears to be in good condition
Loose Rock Overhanging Channel	None observed
Trees Overhanging Channel	None observed
Floor of Approach Channel	Not observable
b. Weir and Training Walls	
General Condition of Concrete	Good for training walls and fair to good for the dam crest
Rust or Staining	Minor amount
Spalling	Spalling at local areas - cracks at construction joints and at buttresses behind dam crest which are about 1-2" wide
Any Visible Reinforcing	None observed
Any Seepage or Efflorescence	Seepage and leakage observed at downstream edge of weir at left abutment, at downstream toe of stone masonry wall from the waste gate to the left abutment
Drain Holes	Stone masonry is dry wall construction

AREA EVALUATED	CONDITION
SPILLWAY (cont.)	
c. Discharge Channel	
General Condition	Good
Loose Rock Overhanging Channel	None observed
Trees Overhanging Channel	None observed
Floor of Channel	Bedrock covered with minor amount of weeds and brush.
Other Obstructions	Some logs and miscellaneous wood. Constriced by a narrow-channeled road bridge, about 40 ft downstream of the dam.

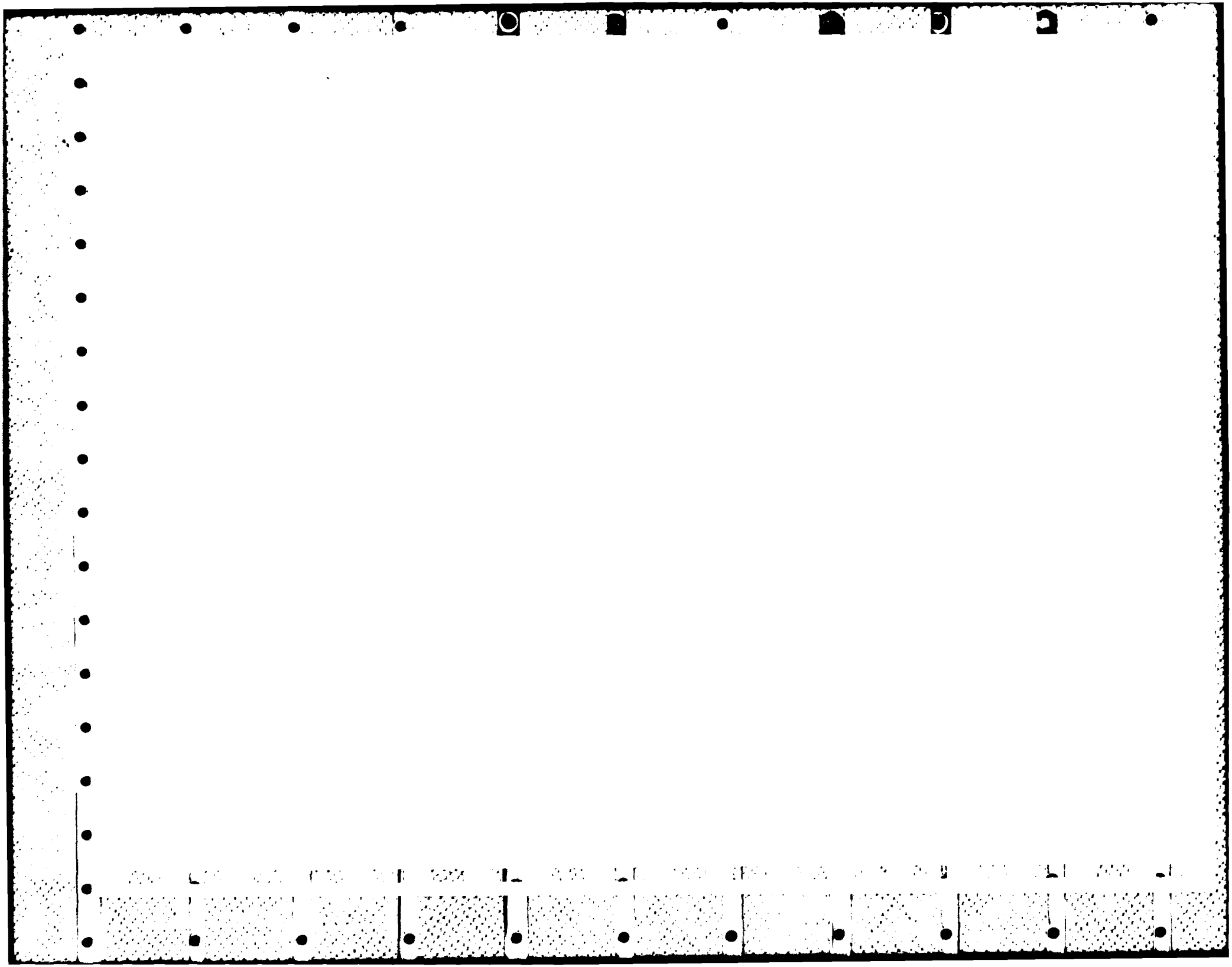
PERIODIC INSPECTION CHECK LIST

PROJECT Gregg Lake Dam DATE Dec. 4, 1979

PROJECT FEATURE Service Bridge NAME Fisher, Decker

DISCIPLINE Structural NAME

AREA EVALUATED	CONDITION
OUTLET WORKS - SERVICE BRIDGE	Not applicable
a. Super Structure	
Bearings	
Anchor Bolts	
Bridge Seat	
Longitudinal Members	
Under Side of Deck	
Secondary Bracing	
Deck	
Drainage System	
Railings	
Expansion Joints	
Paint	
b. Abutment & Piers	
General Condition of Concrete	
Alignment of Abutment	
Approach to Bridge	
Condition of Seat & Backwall	



SUPPLEMENTARY INSPECTION NOTES

GREGG LAKE DAM
ANTRIM, NEW HAMPSHIRE

APPENDIX A

1. CONCRETE STRUCTURES IN GENERAL

a. Concrete Surfaces. The concrete portions of the dam consist of the upstream face of the right embankment, inlet structure for the low level gate, the upstream face and overflow weir of the spillway structure, and the concrete cap placed over the stone masonry spillway crest. The concrete is generally in fair to good condition, except along the upstream face of the right embankment and outlet gate inlet structure which is in good condition. Minor amounts of spalling were observed near construction joints.

b. Stone Masonry Surface. The dry-laid stone masonry portions of the dam include the downstream face of the right embankment and the downstream face of the spillway structure. The stone masonry is in fair to good condition, except along the downstream face of the spillway from the low level gate to the left abutment. The stone masonry wall in this area appears to have tilted downstream such that the top of the wall overhangs the toe by about one foot.

c. Structural Cracking. Cracks about two inches wide were observed at the junction of the concrete cap and the spillway weir. These cracks and the observed tilting of the downstream face of the stone masonry wall indicate movements of the spillway may have occurred.

d. Movement, Horizontal and Vertical Alignment. Cracks in the concrete spillway cap and tilting of the downstream face of the stone masonry spillway appear to indicate that movements of the spillway structure have occurred.

e. Junctions. The junctions of the earth embankments and the spillway appear to be in good condition, except there is a minor amount of leakage at the junction of the left embankment and spillway structure.

f. Drains. Drains were not observed, however the downstream face of the spillway is a stone masonry wall constructed without

mortar. As a result, the wall is free draining and leakage along the downstream toe was observed.

g. Water Passages. The concrete of the overflow spillway and stop log spillway appeared to be in fair to good condition, except where numerous cracks were observed at the low level gate structure and the buttress to the left of the low level gate where the concrete was in fair condition.

h. Seepage and Leakage. Leakage was observed along the downstream toe of the masonry spillway from the left abutment to a point about 50 feet to the right of the low level gate.

i. Monolith Joints. Not applicable.

j. Foundation. The spillway structure appears to be founded on bedrock. The foundation of the upstream face of the right embankment and inlet structure is not known.

k. Abutments. The abutments of the spillway are the concrete upstream face of the right embankment and the left embankment. The abutments appear to be in good condition.

2. EMBANKMENT STRUCTURES

a. Settlement. The downstream edge of the top of the left embankment appeared to be about one foot lower than the upstream edge.

b. Slope Stability. The embankments appear to be founded on bedrock. The right embankment is contained between an upstream concrete retaining wall and a downstream stone masonry retaining wall. Both walls appear to be in fair to good condition. Considerable tree and bush growth was observed at the toe of the downstream right embankment retaining wall and the upstream slope of the right embankment.

c. Seepage. Seepage along the toe of the downstream right embankment was not observed. Some minor seepage along the bedrock surface downstream of the left embankment was observed in the vicinity of shelter structure.

d. Drainage System. No drainage system is known to exist in the earth embankment portions of the dam. A small diameter pipe was observed to be discharging some water from beneath the shelter's slab-on-grade floor.

e. Slope Protection. The upstream face of the right embankment is faced with a concrete retaining wall. The upstream face of the left embankment appears to be protected by riprap from the spillway abutment to a point about 40 feet upstream of the abutment. The riprap was partially hidden by trees and bush. However the visible riprap appeared to be in fair condition.

3. SPILLWAY STRUCTURES

The dam has three stop log spillways, two at the left abutment of the dam and one at the right abutment. A timber waste gate is located at about the middle of the spillway structure. The dam is a stone masonry gravity structure with a concrete upstream face and cap.

a. Control Gates and Operating Machinery. The stop logs are removed manually and provide about a 1.3 foot drop in pond elevation from the overflow spillway crest. The low level gate located about in the middle of the spillway has a manually operated mechanism. The low level gate was not operated at the time of inspection but is reported to be in operating condition. The operating handle for this low level gate is routinely removed after use.

b. Unlined Saddle Spillways. One area upstream of the left embankment, apparently used as a beach or boat landing, has a lower ground surface elevation than the adjacent embankment. This area would be overtopped prior to general overtopping of the embankment. Erosion downstream of this area was not observed.

c. Approach and Outlet Channels. The upstream channel is formed by Gregg Lake. The right spillway approach is clear and unobstructed. The left spillway approach is shallow and partially obstructed by ledge. The channel immediately downstream of the dam is formed primarily by ledge and cobbles. The banks of the downstream channel have a moderate growth of trees and brush (see Photo No. 3).

d. Stilling Basin. The stilling basin consists of the stream channel below the dam. No erosion or scour was in evidence.

4. OUTLET WORKS

The water level in the reservoir is controlled by a sluice gate located about in the middle of the right embankment. This gate is a 16-inch diameter gate valve which is manually operated by turning

a wheel, located in a gatehouse, attached to the valve stem. The sluice gate was operated at the time of inspection and appeared to be operating satisfactorily. A second outlet is the low level gate located in the spillway structure, which was described in section 3.1.h.

a. Intake Structure. The intake structure is located about in the middle of the upstream concrete retaining wall of the right embankment. The concrete portion of the structure extends to the crest of the embankment. Above the embankment crest the structure is wood framed with sheet metal siding and appears to be in good condition. The visible concrete is in good condition. The approach channel was under water but the area appeared to be clear and unobstructed.

b. Operating and Emergency Control Gates. The gate valve for the sluice gate is manually operated at the embankment crest. The gate valve was adjusted during the inspection and appeared to operate satisfactorily.

c. Conduits, Sluices, and Water Passages. The flow channel of the sluice gate from the intake structure to the downstream face of the embankment could not be inspected.

d. Stilling Basin. There is no stilling basin for the service gate discharge. (see Photo No. 4)

e. Approach and Outlet Channel. The approach channel was under water, however, the area appeared to be clear of debris and obstructions. The outlet channel passes through an abandoned mill site before entering a streambed. The channel through the abandoned mill site is lined with stone masonry walls. Some rocks, brush, and trees have fallen into the channel within the abandoned mill site. The outlet channel downstream of the abandoned mill site is generally clear of debris and obstructions.

f. Drawdown Facilities. Drawdown facilities consist of the low level gate located in the spillway structure and the sluice gate located in the right embankment. The low level gate is reported to be operable and the sluice gate is operational.

5. SAFETY AND PERFORMANCE INSTRUMENTATION

None.

6. RESERVOIR

a. Shoreline. Numerous camps and/or year round houses are located along the shoreline of Gregg Lake. No major active or inactive landslide areas were observed on Gregg Lake.

b. Sedimentation. The extent of sedimentation in the lake near the dam could not be observed during the visual inspection, However, flow to the spillway and outlet works did not appear to be impeded.

c. Potential Upstream Hazard. No significant upstream hazard was observed. However, a test flood (1/2 PMF) lake elevation would likely cause shallow flooding at a few cottages around the lake.

d. Watershed Runoff Potential. The watershed is rural with a rolling to mountainous sloping terrain.

7. DOWNSTREAM CHANNEL

Great Brook immediately below the dam is composed of two channels which consist of ledge and cobbles as shown in Photos No. 2 and 3. The confluence of the two channels is located about 200 feet downstream of the dam. The banks of both channels are forested. Great Brook joins the Contoocook River about 3 1/2 miles below Gregg Lake Dam. The channel downstream of the dam is generally clear of debris and obstructions except for the restriction caused by the White Birch Point Road Bridge located about 40 feet downstream of the spillway structure. Great Brook has a fairly steep gradient from Gregg Lake to the town of Antrim. Numerous abandoned dam sites are located downstream of the Gregg Lake Dam.

8. OPERATION AND MAINTENANCE FEATURES

The dam appears to be maintained on an as-needed basis. The left embankment, downstream slope of the right embankment and the sluice gate outlet channel require maintenance. The cracks in the spillway structure should be reviewed to determine if movements of the spillway have been or are occurring.

APPENDIX B

ENGINEERING DATA

This appendix contains and/or identifies the engineering data collected either from project records or other sources of data developed as a result of the visual inspection. The contents of this appendix are listed below.

Appendix	Description
B-1	General Project Data
B-2	Past Inspection Reports

APPENDIX B-1

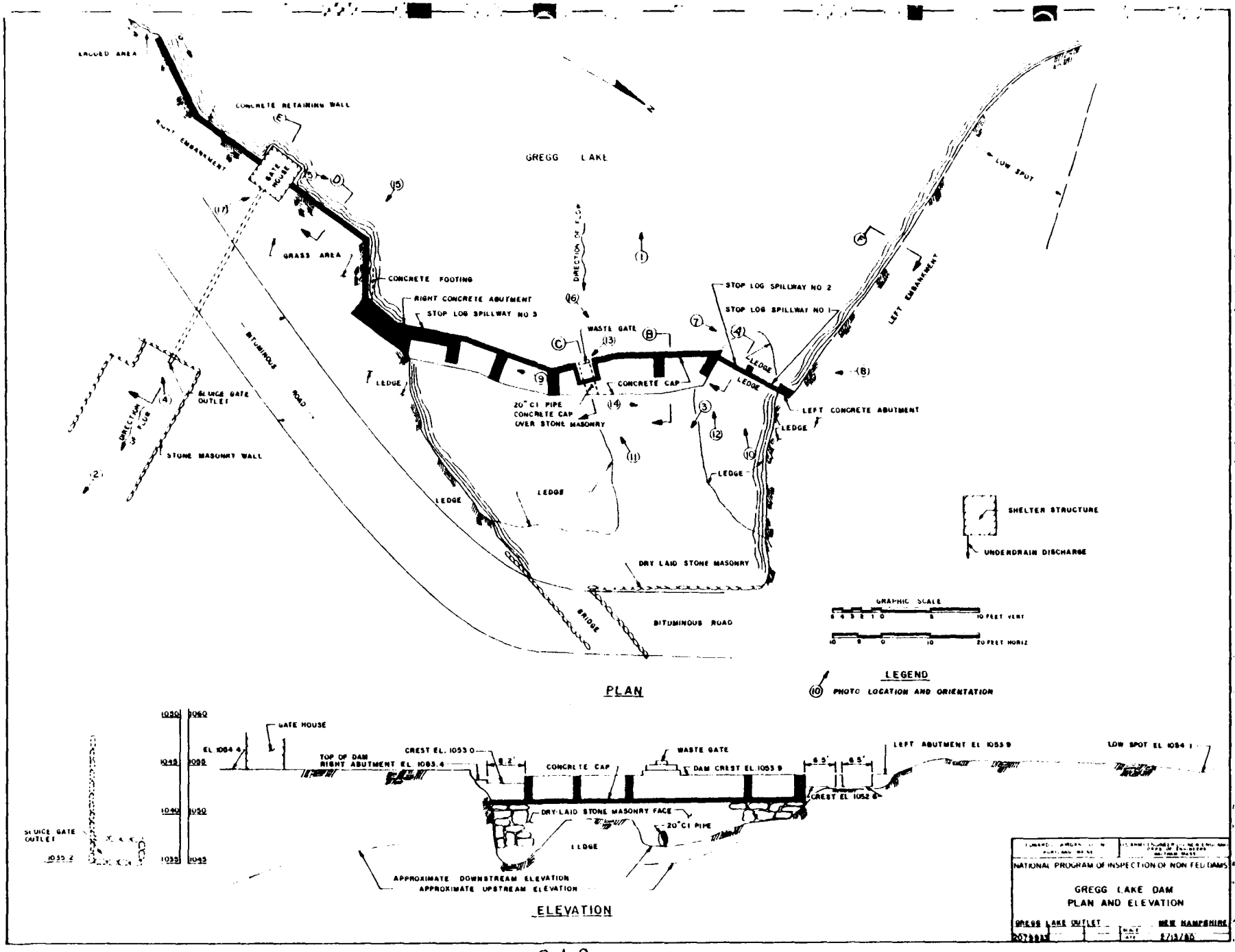
GENERAL PROJECT DATA

I. The following information is available at the New Hampshire Water Resources Board, 37 Pleasant Street, Concord, New Hampshire 03301.

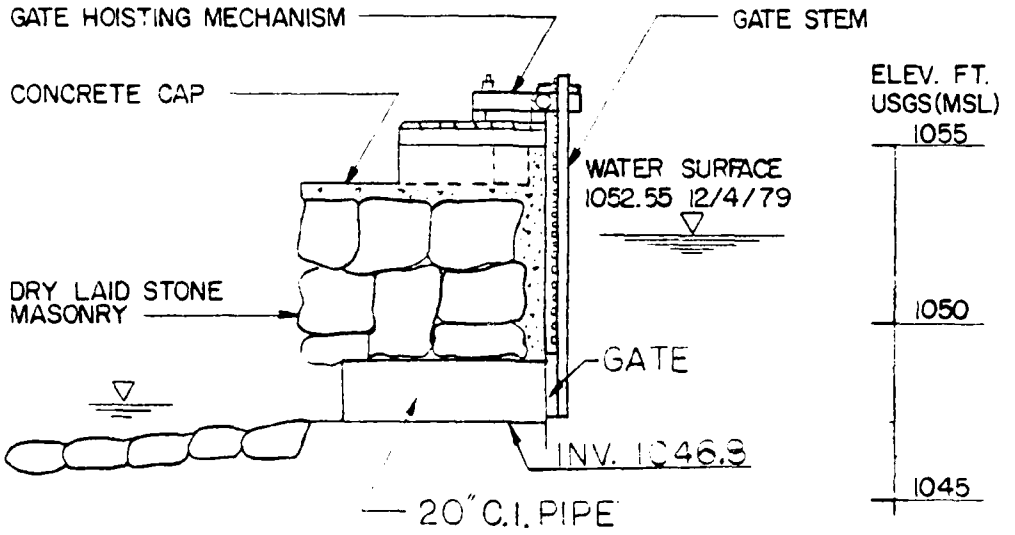
A. Periodic inspection reports, copies of which are attached as Appendix B-2 of this report.

B. Miscellaneous correspondence and inventory data pertaining to the dam.

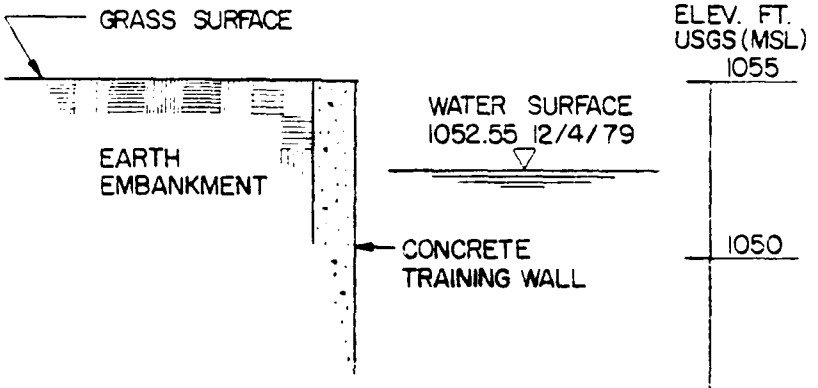
II. The following plan, profile and cross-section sketches were developed from a limited stadia survey conducted during the visual inspection, field notes taken by inspection team members and photographs taken during the inspection. The survey was referenced to an arbitrary local datum and subsequently converted to MSL reference by interpolation from U.S.G.S. Map, Hillsboro, N.H., Quadrangle.


GRASS AREA
CONCRETE RETAINING WALL
EARTH EMBANKMENT
GATE HOUSE
GREGG LAKE
LOW SPOT
DIRECTION OF FLOW
GRASS AREA
CONCRETE FOOTING
RIGHT CONCRETE ABUTMENT
STOP LOG SPILLWAY NO 3
STOP LOG SPILLWAY NO 2
STOP LOG SPILLWAY NO 1
WASTE GATE
LEFT EMBANKMENT
BITUMINOUS ROAD
LEDGE
CONCRETE CAP
20" CI PIPE
CONCRETE CAP
OVER STONE MASONRY
LEFT CONCRETE ABUTMENT
SLUICE GATE
OUTLET
STONE MASONRY WALL
DRY LAID STONE MASONRY
BRIDGE
BITUMINOUS ROAD
SHELTER STRUCTURE
UNDERDRAIN DISCHARGE
GRAPHIC SCALE
10 FEET VERT
20 FEET HORIZ
LEGEND
PHOTO LOCATION AND ORIENTATION
PLAN
GATE HOUSE
EL 1064.4
TOP OF DAM
RIGHT ABUTMENT EL 1063.4
CREST EL. 1053.0
8.2'
CONCRETE CAP
WASTE GATE
DAM CREST EL 1053.9
6.5'
6.5'
LEFT ABUTMENT EL 1055.9
LOW SPOT EL 1064.1
CREST EL 1052.6
DRY-LAID STONE MASONRY FACE
20"CI PIPE
LEDGE
SLUICE GATE
OUTLET
APPROXIMATE DOWNSTREAM ELEVATION
APPROXIMATE UPSTREAM ELEVATION
ELEVATION
NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS
GREGG LAKE DAM
PLAN AND ELEVATION
GREGG LAKE OUTLET
NEW HAMPSHIRE
8/13/80

B-1-2



SECTION C



SECTION D

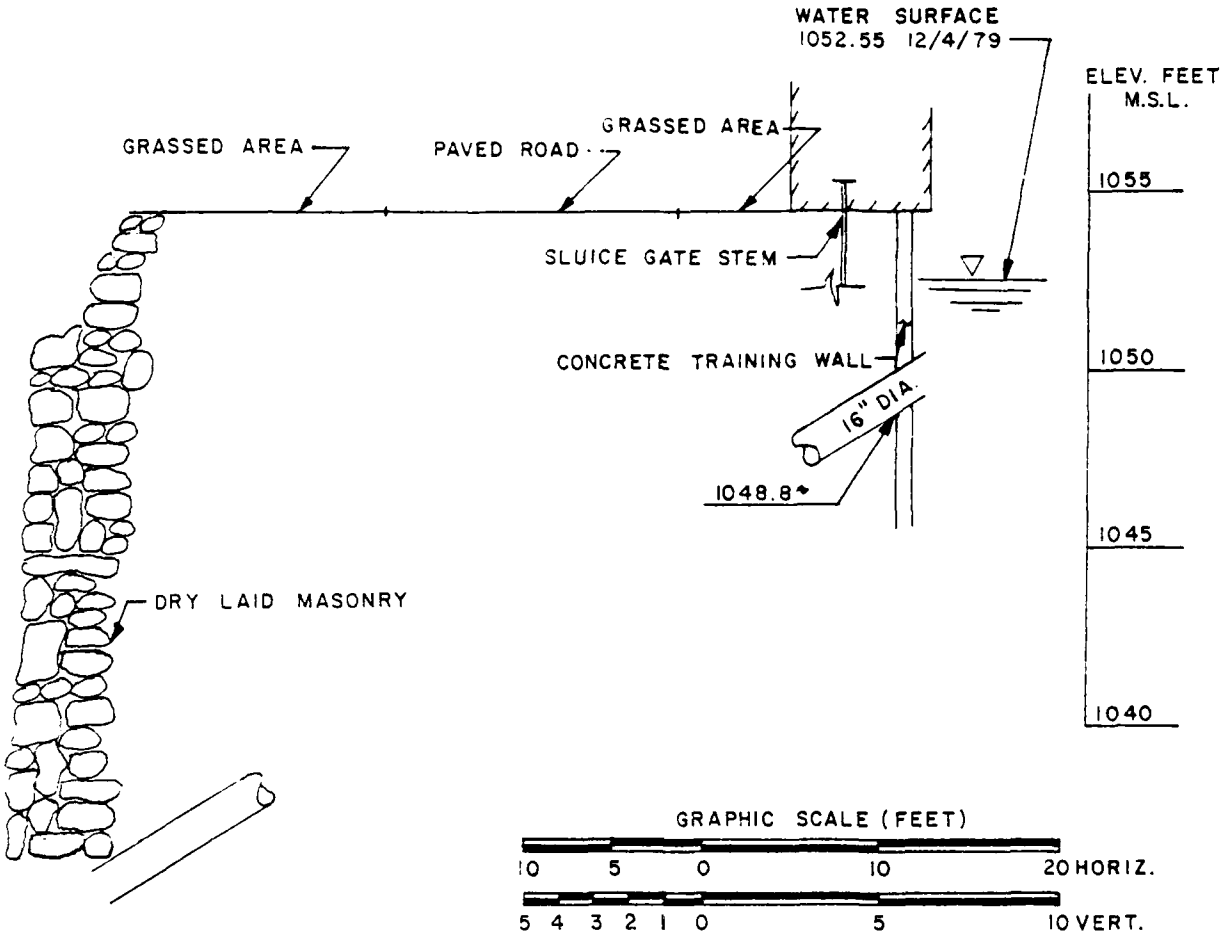
HORIZONTAL SCALE

0 5 10 FEET

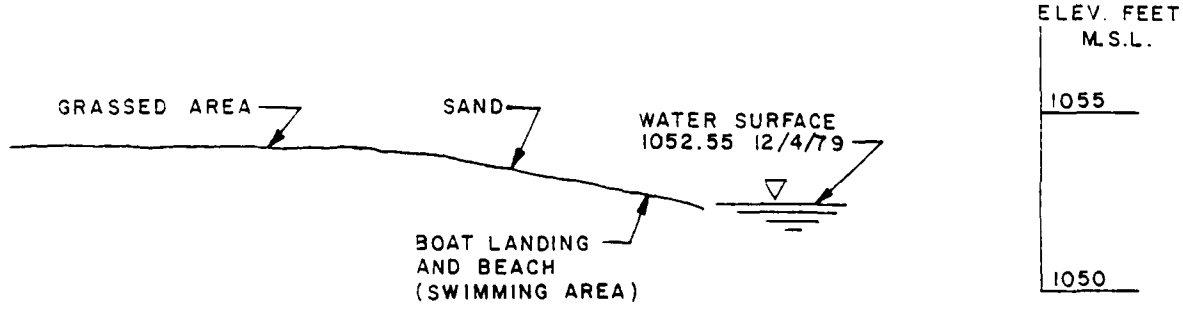
GREGG LAKE DAM
X-SECTIONS

GREGG LAKE OUTLET N.H.

20799.33 2/15/80



SECTION E



SECTION F

NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS

GREGG LAKE DAM
X-SECTIONS

GREGG LAKE OUTLET N.H.

20799.35 3/13/80

APPENDIX B-2

PAST INSPECTION REPORTS

Attached are copies of inspection reports dated May 26, 1965, and 1925 pertaining to the Gregg Lake Dam. These reports are on file with the New Hampshire Water Resources Board in Concord, NH.

May 26, 1965

Mr. Robert A. Caughey
Antrim Center
Antrim, New Hampshire

Dear Mr. Caughey:

Due to pressure of work here I was unable to meet you Friday afternoon, May 21 although I tried to contact you. I trust this report is what you desire.

On the afternoon of May 25, 1965, I visited Gregg Pond dam in Antrim to inspect it for safety. The following notes are the findings:

Present Condition: Generally good, however, the left abutment dike has two pondside erosions about fifteen feet long that weaken the earth dike. Trees on the dike are 8 to 10 inches in diameter and could rip holes in the dike if wind overturned them. Also, the deep gate just left of the middle of the dam leaks slightly and the exposed wooden deck is rotting.

Suggested improvements:

1. Remove all trees from top and slopes of 180' long dike on left abutment.

2. Raise the dike with impervious material to at least 24 inches above the top of concrete walls adjacent to shallow spillway sections. This raising should include widening the top of dike to at least eight feet wide with 2½:1 side slopes.

3. From the end of concrete wall on the right abutment, an earth dike of like dimensions should run the short distance to high ground.

4. Concrete abutments should be built up two feet from top of present concrete wall to hold the earth dike at both left and right ends of the dam.

5. Replace deep gate timber and platform with treated timber.

Notes: Present concrete facing to dam is substantial with a few minor cracks that are no menace structurally.

Present gate on right end of dam controlled from the gate house was apparently open slightly with a fair discharge downstream. This building is in good shape and probably the gate, gate stem and mechanism are satisfactory. The lake is now about eight inches below spillway crest or about 20 inches below top of concrete facing.

Very truly yours,

Francis C. Moore
Civil Engineer

FCM/cam

NEW HAMPSHIRE WATER RESOURCES BOARD

INVENTORY OF DAMS AND WATER POWER DEVELOPMENTS

DAM

BASIN Merrimack NO. ~~14~~ 3 9.03 53.1 psc
RIVER Gregg Lake MILES FROM MOUTH D.A.SQ.MI. (4.7 wrc
TOWN Antrim OWNER Clinton & Salmon Water Co.
LOCAL NAME OF DAM Greggs Lake Dam
BUILT rebuilt 1916 DESCRIPTION Concrete & Stone
1928

POND AREA-ACRES 212.10 DRAWDOWN FT. POND CAPACITY-ACRE FT.
HEIGHT-TOP TO BED OF STREAM-FT. 12 20 MAX. MIN.
OVERALL LENGTH OF DAM-FT. ~~40~~ 161 MAX. FLOOD HEIGHT ABOVE CREST-FT.
PERMANENT CREST ELEV. U.S.G.S. LOCAL GAGE
TAILWATER ELEV. U.S.G.S. LOCAL GAGE
SPILLWAY LENGTHS-FT. 23 & 6 108 FREEBOARD-FT. 13" & 11"
FLASHBOARDS-TYPE, HEIGHT ABOVE CREST

WASTE GATES-NO.	WIDTH	MAX. OPENING	DEPTH SILL BELOW CREST
2	1.5	1.5	10
1	18" Pipe		19'

REMARKS Condition good

Co-ordinates from A ≡
43° 00' + 4750 yds.
72° 00' — 1900 yds.

POWER DEVELOPMENT

UNITS	NO.	RATED HP	HEAD FEET	C.F.S. FULL GATE	KW	MAKE

USE Storage Water Supply
Antrim

REMARKS Water supply for Town of Antrim
L.S.G.- information from H.W. Johnson C 132, 132-A
Shown on H.W. Johnson of Goodell Co. who own 2/3 shares in
Great Brook Improvement Co.

COPY

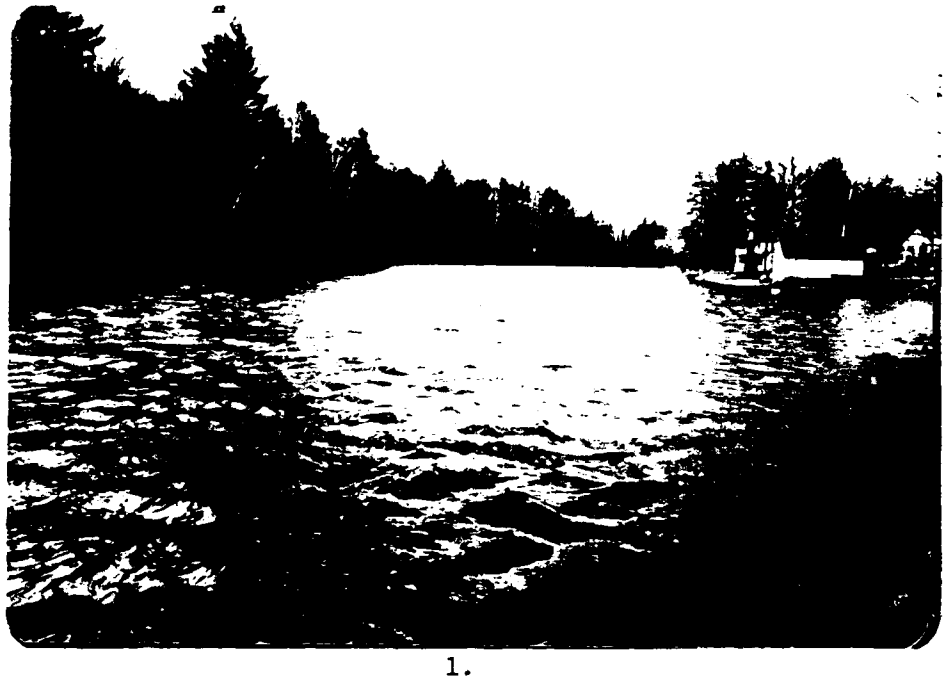
10/16/36 AE
DATE 1937 P.S.C
10/2/37

B-2-4

APPENDIX C

PHOTOGRAPHS

The following are photographs referenced in this report. See Sheet B-1-2 for photograph locations and orientations.



1.

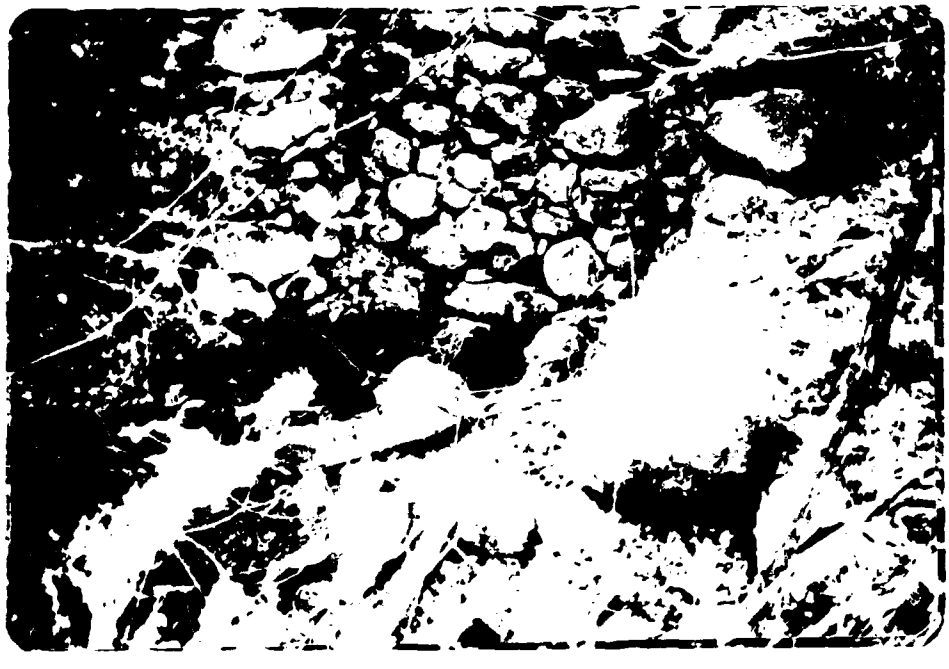
View Upstream

2.

Downstream of Sluice Gate

3.

Downstream of Spillway

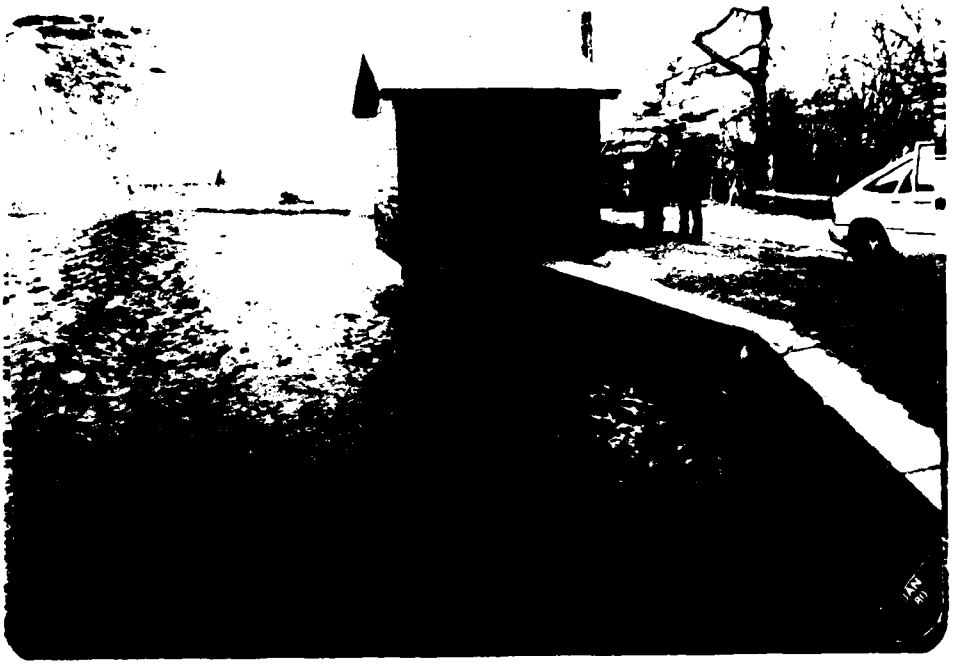


4.

Sluice Gate Outlet

5.

View of Crest From Sluice Gate Structure

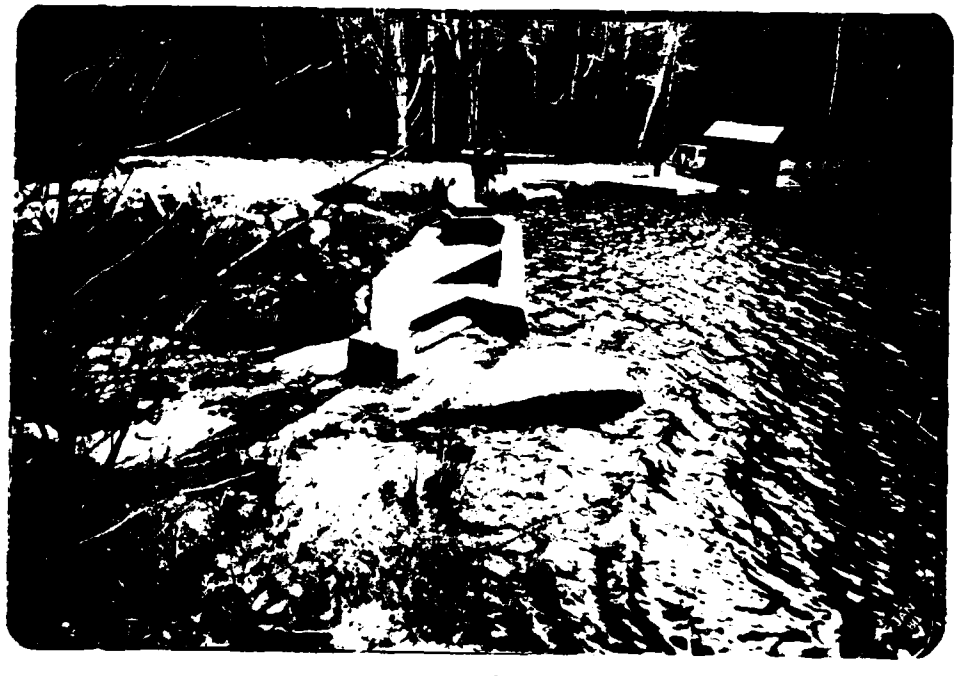


6.

Upstream Face of Right Embankment

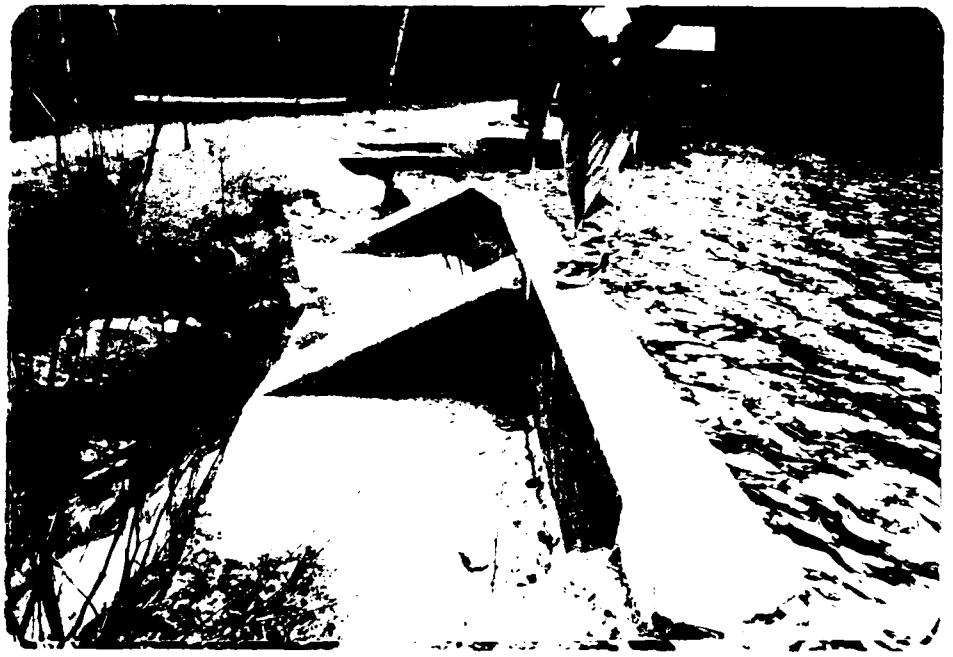
7.

Stop Log Spillways #1 & #2



8.

View of Crest From Left Abutment



9.

Separation of Butresses
From Dam Crest

10.

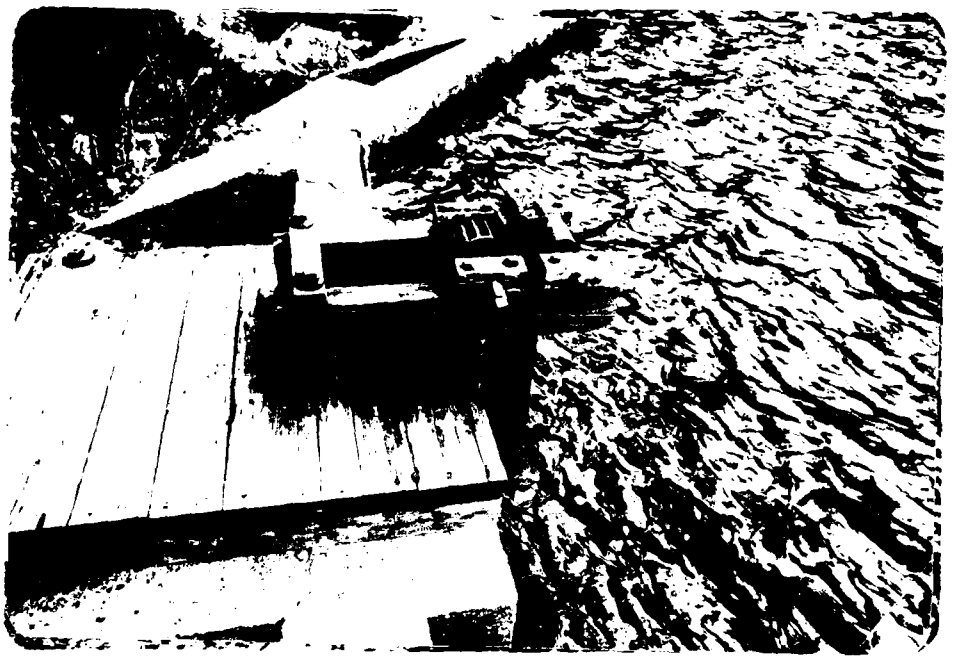
Downstream Face From Left Abutment

11.

Low Level Gate

12.

Downstream Face Near Left Abutment



13.

Low Level Gate Hoisting Mechanism

14.

Bulge In Downstream Face

15.

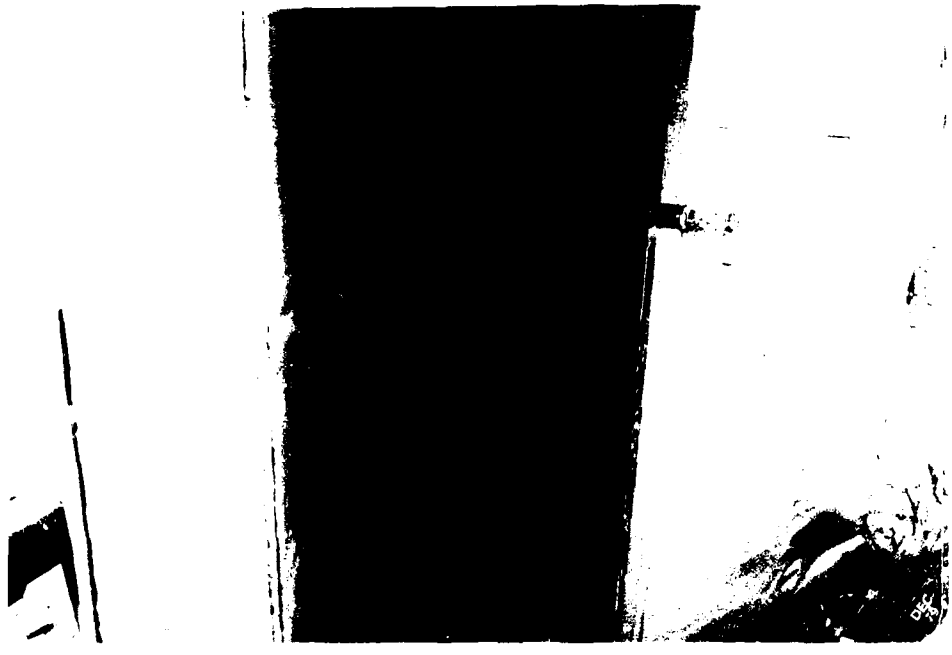
Chipped Concrete - Right Upstream Retaining Wall

16.

Upstream Face of Dam

17.
Upstream of Right Embankment

18.
Upstream of Left Embankment



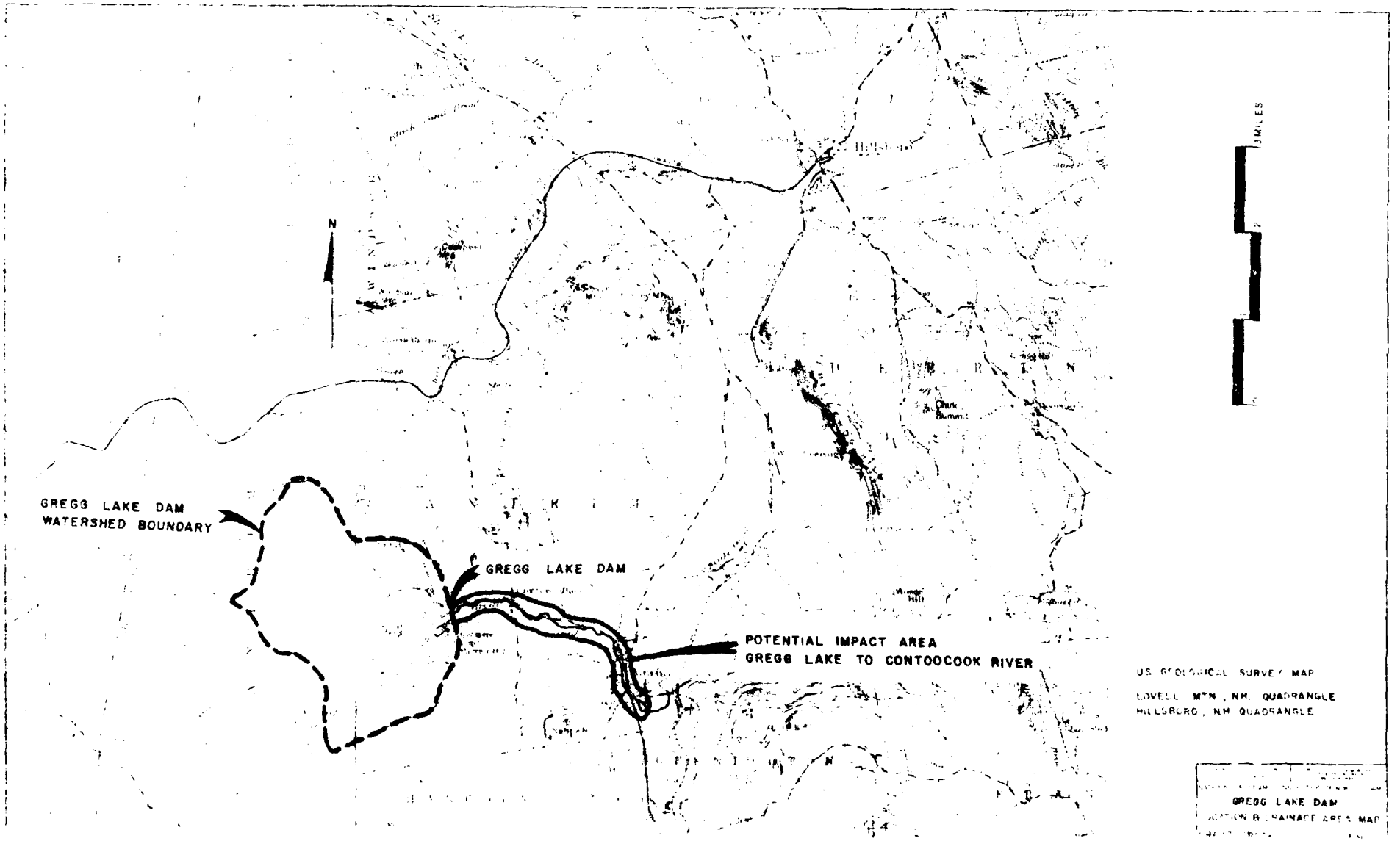
19.

Sluice Gate Stem

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

Hydrologic computations pertinent to this investigation are attached. The following figure shows the watershed at the Gregg Lake Dam.


N
GREGG LAKE DAM
WATERSHED BOUNDARY
GREGG LAKE DAM
POTENTIAL IMPACT AREA
GREGG LAKE TO CONTOOCOOK RIVER
1 MILES
U.S. GEOLOGICAL SURVEY MAP
LOVELL MTN., NH. QUADRANGLE
HILLSBORO, NH QUADRANGLE
GREGG LAKE DAM

PROJECT	COMP. BY	JOB NO.
AREAS	BTB	20799 33
	CHK. BY JD	DATE 1-7-80

GREGG LAKE DAM D.A. ..... 4.7 SQ MI

GREGG LAKE SURFACE AREA @ EL 1053 ... 212 AC

GREGG LAKE MAX. DEPTH ..... 31'

GREGG LAKE DAM HEIGHT ..... 9'

100 YEAR FREQ FLOOD FLOW ..... 1035 CFS

SEPT 1938 FLOOD OF RECORD NEARLY OVERTOPPED DAM (EYE WITNESS)

FROM 22 AUG '79 COE INVENTORY:
MAX IMPOUNDING CAPACITY ..... 1300 AC-FT
NORMAL IMPOUNDING CAPACITY ..... 1000 AC-FT
BASED ON DEPTH AND AREA OF LAKE, IMPOUNDING CAPACITIES APPEAR TO BE CORRECT.

PROJECT	COMP BY	JOB NO.
SPILLWAY HYDRAULICS	BTB	20799 33
	CHK BY JD	DATE 1-3-80

ELEV[1]	LENGTH = 8.2' CREST EL = 1053.0 SOUTHERLY SPILLWAY C* VALUE	FLOW CFS	LENGTH = 13.0' CREST EL = 1052.6 NORTHERLY SPILLWAY C* VALUE	FLOW CFS	TOTAL SPILLWAY FLOW, CFS
1052.6	—	—	2.63	—	
1053	—	—		9	9
1054	2.66	22		57	79
1055	2.85	66		127	193
1056	3.20	136		214	350
1057	3.32	218		316	534
1058	↓	304		429	733
1059		400		554	954
1060		504	↓	688	1192
TOP OF DAM 1053.4	2.66	6	2.63	24	30

FLOW CALCULATION BASED ON $Q = CLH^{3/2}$

[1] SOUTHERLY SPILLWAY ELEV = 1053.0 WAS ASSUMED BASED ON HILLBORO, NH USGS QUAD GREGG LAKE ELEV 1053.0

* FROM BRATER & KING, HANDBOOK OF HYDRAULICS 6TH EDITION, CHAPTER 5. NORTHERLY SPILLWAY APPROACH IS SHALLOW AND PARTIALLY OBSTRUCTED. ∴ C FOR NORTHERLY SPILLWAY IS LESS THAN C FOR SOUTHERLY SPILLWAY.

SOUTHERLY ABUTMENT @ EL 1053.4; SPILLWAY CAPACITY = 30 CFS

PROJECT	COMP. BY	JOB NO.
GATE HYDRAULICS	BTB	2079933
	CHK. BY: JJD	DATE: 1-4-80

ELEV[1]	$Q = CA\sqrt{2gh}$ C = 0.7 20" DIA OUTLET CONTROL[2] GATE @ CENTER SECTION HEAD, FT	FLOW CFS	$Q = CA\sqrt{2gh}$, 16" DIA, C = 0.7, INLET CONTROL[2] GATE @ GATE HOUSE HEAD, FT	FLOW, CFS	TOTAL GATE FLOW, CFS
1053	4.5	26	3.5	15	15
1054	5.5	29	4.5	17	17
1055	6.5	31	5.5	18	18
1056	7.5	34	6.5	20	20
1057	8.5	36	7.5	21	21
1058	9.5	38	8.5	23	23
1059	10.5	40	9.5	24	24
1060	11.5	42	10.5	25	25

NOTE: SINCE CENTER SECTION GATE IS INACCESSIBLE DURING FLOOD CONDITIONS AND SINCE IT IS NORMALLY CLOSED, TOTAL GATE FLOW IS SET EQUAL TO GATE HOUSE FLOW (GATE HOUSE IS MORE READILY ACCESSIBLE AND GATE IS USUALLY OPEN).

DOWNSTREAM WATER DEPTH NEAR DAM TAKEN AS 1047.7, CG, WATER WOULD BE SKIMMING OVER THE ROAD DOWNSTREAM OF THE DAM WHEN THE DAM OVERTOPS, (ROAD ACTS AS HYDRAULIC CONTROL - SEE Page D-11 FOR CALCULATION)

[1] SOUTHERLY SPILLWAY ELEV 1053.0 WAS ASSUMED BASED ON HILLSBORO, N.H. USGS QUAD GREGG LAKE EL = 1053.0

[2] OUTLET CONTROL AT CENTER SECTION GATE, (EG. TAILWATER CONTROLED AT HIGH FLOWS BY BRIDGE IMMEDIATELY DOWNSTREAM.) HEAD BASED ON TAILWATER BEING AT CROWN OF PIPE = EL 1046.5
INLET CONTROL AT GATE HOUSE CULVERT (PIPE IS VERY STEEP & TAILWATER BELOW 1047.7). HEAD BASE ON HEIGHT OVER E = 1049.5.

PROJECT	COMP. BY	JOB NO.
OVERTOP OF DAM HYDRAULICS	BTB	20799 33
	CHK. BY JD	DATE 1-3-80

ELEV[1]	LENGTH = 50', BREADTH = 1', EL = 1053.9 MAIN DAM C* VALUE	FLOW CFS	LENGTH = 5', BREADTH = 4', EL = 1055.0 SECTION AT CENTER GATE C* VALUE	FLOW CFS	TOTAL OVERTOP OF DAM CFS
1053.9		—			
1054	3.03	5			5
1055	3.30	191		—	191
1056	3.32	505	2.67	13	518
1057	↓	906	2.68	38	944
1058		1378	2.73	71	1449
1059		1912	2.79	112	2024
1060		2501	3.07	172	2673
			3.32		
			↓		

FLOW CALCULATION BASED ON $Q = CLH^{3/2}$

[1] SOUTHERLY SPILLWAY ELEV = 1053.0 WAS ASSUMED BASED ON HILLSBORO, N.H. USGS QUAD GREGG LAKE EL

*FROM BRATER & KING, HANDBOOK OF HYDRAULICS 6TH EDITION, CHAPTER 5.

PROJECT	COMP. BY	JOB NO.
OVERBANK FLOW HYDRAULICS	BTB	20799 33
	CHK. BY JD	DATE 1-4-80

ELEV[1]	LENGTH = 77' EL = 1054.3 SOUTHERLY EMBANKMENT WEIR C* VALUE	LENGTH = 77' EL = 1054.3 SOUTHERLY EMBANKMENT WEIR FLOW, CFS	LENGTH = 63' EL 1055.4 NORTHERLY EMBANKMENT WEIR C* VALUE	LENGTH = 63' EL 1055.4 NORTHERLY EMBANKMENT WEIR FLOW CFS	TOTAL OVERBANK FLOW, CFS
1054.3	2.63				
1055	↓	119	2.63		119
1056		449	↓	77	526
1057		898		335	1233
1058		1441		695	2136
1059		2063		1132	3195
1060	↓	2756	↓	1635	4391

WEIR FLOW CALC, BASED ON $Q = CLH^{3/2}$

1 SOUTHERLY SPILLWAY ELEV = 1053.0 WAS ASSUMED BASED ON HILLSBORO, N.H. USGS QUAD GREGG LAKE EL

* FROM BRATER & KING, HANDBOOK OF HYDRAULICS 6TH EDITION, CHAPTER 5.

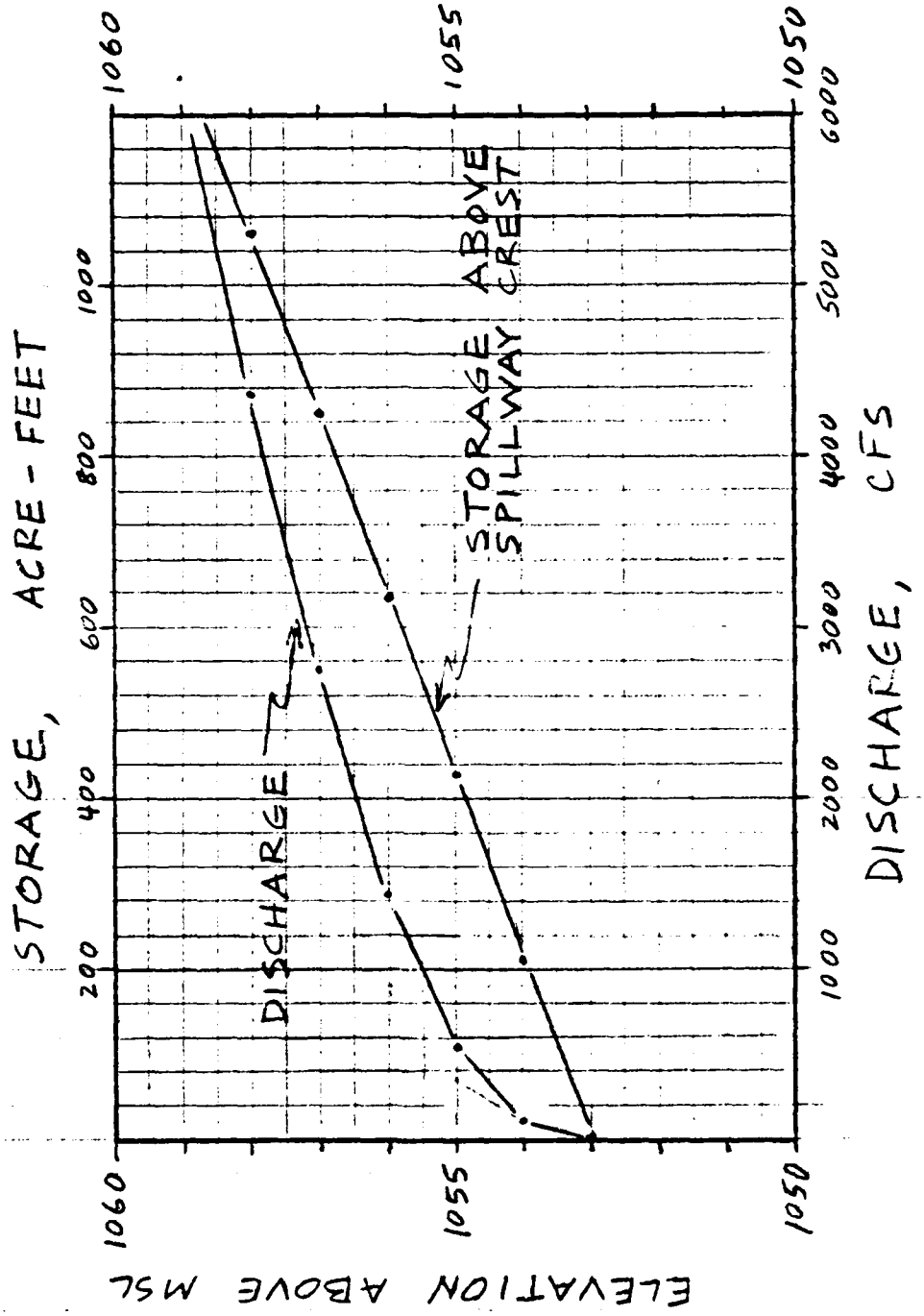
PROJECT	COMP. BY	JOB NO.
RATING TABLE - DAM HYDRAULICS	BTB	2079933
	CHK. BY JD	DATE 1-7-80

ELEV[1]	TOTAL GATE FLOW, CFS	TOTAL SPILLWAY FLOW, CFS	TOTAL OVERTOP OF DAM FLOW, CFS	TOTAL OVERBANK FLOW, CFS	TOTAL FLOW, CFS
1053	15	9			24
1054	17	79	5		101
1055	18	193	191	119	521
1056	20	350	518	526	1414
1057	21	534	944	1233	2732
1058	23	733	1449	2136	4341
1059	24	954	2024	3195	6197
1060	25	1192	2673	4391	8281

1 SOUTHERLY SPILLWAY ELEV WAS ASSUMED TO BE ELEV 1053.0 BASED ON HILLSBORO NH USGS QUAD GREGG LAKE EL 1053.0

GREGG LAKE AREA = 212 ACRES. SINCE LAKE BANKS ARE STEEP, STORAGE ABOVE SPILLWAY CREST COMPUTED AS A MULTIPLE OF LAKE AREA TIMES HEIGHT ABOVE SPILLWAY CREST.

PROJECT	COMP. BY	JOB NO.
GREGG LAKE DAM STORAGE - DISCHARGE CURVE	BTB	2079933
	CHK. BY JJP	DATE 4-2-80



PROJECT	COMP. BY	JOB NO
TEST FLOOD	BTB	20799 33
	CHK. BY	DATE
	JJD	1-7-80

DRAINAGE AREA = 4.7 SQ MI

SIZE CLASSIFICATION = INTERMEDIATE
(MAX STORAGE = 1300 AC-FT)

HAZARD CLASS = SIGNIFICANT ∴ TEST FLOOD = ½ PMF

SLOPE = ROLLING TO MOUNTAINOUS

FROM COE "PRELIMINARY GUIDANCE FOR ESTIMATING MAX PROB DISCHARGES":

PMF = 2100 CFS/SQ MI

∴ ½ PMF = 1050 CFS/SQ MI

OR ½ PMF = 1050(4.7) ≅ 4,950 CFS

EFFECT OF SURCHARGE STORAGE ON ½ PMF

½ PMF INFLOW = 4,950 CFS

1) SURCHARGE HEIGHT TO PASS ½ PMF = 5.7' @ EL 1058.70

VOLUME OF SURCHARGE ($STOR_1$) = 1130 AC-FT

OR $STOR_1 = \frac{1130}{4.7(640)} \times 12 = 4.5''$

$$Q_{p2} = Q_{p1}\left(1 - \frac{STOR_1}{9.5}\right) = 4950\left(1 - \frac{4.5}{9.5}\right) = 2,605 \text{ CFS}$$

PROJECT	COMP. BY	JOB NO.
TEST FLOOD	BTB	20799 33
	CHK. BY JJD	DATE 1-7-80

2.) SURCHARGE HEIGHT TO PASS Q_{P_2} = 3.9'

@EL 1056.9

$STOR_2$ = 830 AC-FT

OR $STOR_2 = \frac{830}{4.7(640)} \times 12 = 3.3''$

$STOR_{AVE} = \frac{4.5+3.3}{2} = 3.9''$

$Q_{P3} = 4950\left(1 - \frac{3.9}{9.5}\right) = 2,918$ CFS

3.) SURCHARGE HEIGHT TO PASS Q_{P_3} = 4.2'

@ EL 1057.2

$STOR_3$ = 880 AC-FT

OR $STOR_3 = \frac{880}{4.7(640)} \times 12 = 3.5''$

$STOR_{AVE} = \frac{3.9+3.5}{2} = 3.7$

$Q_{P4} = 4950\left(1 - \frac{3.7}{9.5}\right) \cong 3000$ CFS

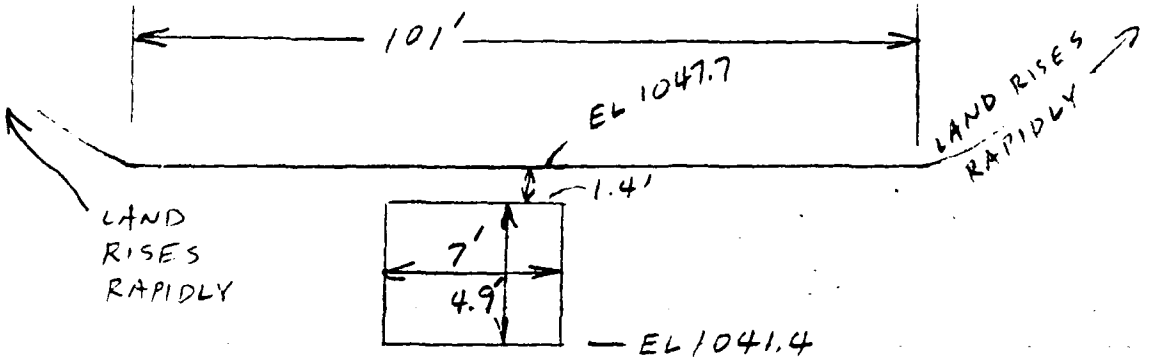
@ ELEV 1057.4

PEAK DISCHARGE OF ½ PMF = 3000 CFS
STAGE = 1057.4

SOUTHERLY ABUTMENT OVERTOP = 4.0'
NORTHERLY ABUTMENT OVERTOP = 3.5'

SPILLWAY CAPACITY = 1.0 % OF ½ PMF
TOTAL STORAGE CAPACITY @ ½ PMF = 1000 + 880 = 1880 AC-FT

PROJECT	COMP. BY	JOB NO.
RATING CURVE AT FIRST DOWNSTREAM BRIDGE	BTB	20799 33
	CHK. BY JJD	DATE 1-2-80



FIRST DOWNSTREAM BRIDGE IS APPROX 43' DOWNSTREAM OF GREGG LAKE DAM. THE LOWEST SPILLWAY AT THE DAM IS AT EL 1052.6.

ELEV	$Q = CA\sqrt{2gh}$ BRIDGE FLOW, C=0.7 CFS	C* VALUE	CREST EL = 1047.7 WEIR FLOW CFS	TOTAL FLOW CFS	
1048	251	2.63	43	294	
1049	317	↓	393	710	
1050	371		927	1298	
1051	418		1592	2010	
1052	460		2369	2829	
1052.6	484		2881	3365*	VS
1053.	499		3241	3740	3000
1054	535		4200	4735	OVER THE DAM OK

* AT ½ PMF FLOW = 3,000 CFS, THE GREGG LAKE DAM SPILLWAYS WOULD NOT LIKELY BE SUBMERGED.

1 SUPPORTED FLOW DOWNSTREAM, ∴ OUTLET CONTROL USED. TAILWATER ASSUMED TO BE AT ELEV. OF CROWN OF CULVERT.

PROJECT	COMP. BY	JOB NO.
DAM FAILURE HYDROGRAPHS	BTB	20799 33
	CHK. BY JJD	DATE 1-7-80

FROM COE "RULE OF THUMB" GUIDANCE FOR ESTIMATING DOWNSTREAM DAM FAILURE HYDROGRAPHS:

$$Q_{p1} = 8/27\, W_b \sqrt{g}\, Y_o^{3/2}$$

$\frac{1}{2} Q_p T = 12.1 S$ $\quad Y_o = 1053.4 - 1045.4 = 8'$

$Y_o = 8'$, $W_b = 25'$ {SECTION NEAR NORTHERLY SPILLWAY}[1]

$$Q_{p1} = 8/27 (25) \sqrt{g}\, 8^{3/2} \cong 951 \text{ CFS}$$

TOTAL FLOW = Q_{p1} + TOTAL DISCHARGE AT NORTHERLY & SOUTHERLY SPILLWAYS AT TOP OF DAM

TOTAL FLOW = 951 + 30 $\cong$ 981 CFS

$S = 1300$ AC-FT, FROM AUG '79 COE INVENTORY

$$T = \frac{12.1 S}{\frac{1}{2} Q_p} = \frac{12.1 (1300)}{\frac{1}{2} (981)} = 32 \text{ HRS}$$

1 IN THE BEST JUDGEMENT OF GEOTECHNICAL PERSONNEL, THE MOST LIKELY LOCATION FOR FAILURE IS IN THE 25' SECTION OF DAM AT THE NORTHERLY SPILLWAY. MOVEMENT HAS OCCURRED IN THIS SECTION OF DAM, CAUSING THE TOP TO TIP DOWNSTREAM.

PROJECT	COMP. BY	JOB NO.
DAM FAILURE HYDROGRAPHS	BTB	20799 33
	CHK. BY JJD	DATE 1-8-80

AT X-SECTION 1 : (SHOWN ON D-15)

Q_{p1} = 980 CFS

Q_{p2} @ X-SECTION ① @ DEPTH = 10.3'

$$Q_{p2}\,(TRIAL) = Q_{p1}\left(1 - \frac{V_1}{S}\right)$$

$$Q_{p2}\,(TRIAL) = 980\left(1 - \frac{14}{1300}\right) \rightarrow 0$$, STORAGE INSIGNIFICANT

Q_{p2} = 980 CFS @ 1.3 ABOVE ROAD

AT X-SECTION ①

3 HOUSES MAY BE FLOODED TO ABOUT 1' DEPTH

AT X-SECTION 2 : (SHOWN ON D-16)

Q_{p2} = 980 CFS

Q_{p3} @ X-SECTION ② @ DEPTH = 9.0'

THERE IS ABOUT 1.5 TIMES AS MUCH STORAGE BETWEEN THE DAM & X-SECT ② AS THERE IS BETWEEN THE DAM & X-SECT ①

$$Q_{p3}\,(TRIAL) = 980\left(1 - \frac{1.5(14)}{1300}\right) \approx 965 \text{ CFS}$$

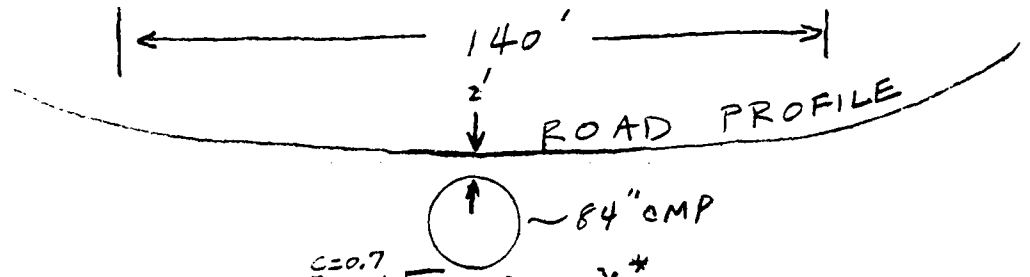
Q_{p3} = 965 CFS @ 1.0' ABOVE ROAD

AT X-SECTION ②

3 HOUSES MAY BE FLOODED TO ABOUT 1' DEPTH

DOWNSTREAM OF X-SECT ② THERE WOULD LIKELY ONLY BE SOME MINOR FLOODING (<6") OF 2 OR 3 MORE HOUSES ON GREAT BROOK. DOWNSTREAM OF THE CONFLUENCE OF GREAT BROOK & CONTOOCOOK RIVER, 1,150 CFS IS APPROX EQUAL TO PEAK SPRING RUNOFF. ∴ MIN. DAMAGE IN RIVER.

PROJECT	COMP. BY	JOB NO.
SECTION (1)	BTB	20799 33
BRIDGE APPROX 3800' DOWNSTR	CHK. BY JJD	DATE 1-8-80



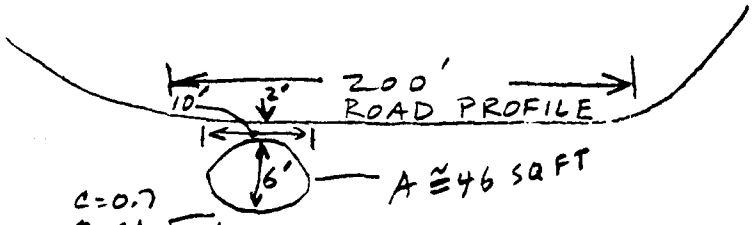
$C=0.7$ $Q=CA\sqrt{2gh}$ $Q=CLH^{3/2}$*

DEPTH	PRES.[1] FLOW, CFS	WEIR FLOW, CFS	TOTAL FLOW, CFS	STORAGE AC-FT
9	306	0	306	
10	374	368	742	11
11	432	1041	1473	16
12	483	1913	2396	24
13	530	2946	3476	31
14	572	4117	4689	38
15	611	5411	6022	

* $C=2.63$, FROM KING & BRATER, HANDBOOK OF HYDRAULICS, 6TH EDITION CHAPTER 5.

[1] SUPPORTED FLOW DOWNSTREAM, ∴ OUTLET CONTROL USED, TAILWATER ASSUMED TO BE AT ELEV. OF CROWN OF CULVERT.

PROJECT	COMP. BY	JOB NO.
SECTION (2) BRIDGE APPROX 1.2 MI DOWNSTR	BTB	2079933
	CHK. BY JJD	DATE 1-8-80



$C = 0.7$

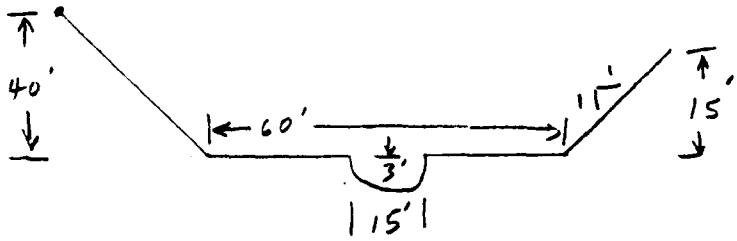
$Q = CA\sqrt{2gh}$

DEPTH	PRES FLOW[1]	WEIR* FLOW	TOTAL FLOW, CFS
8	365	0	365
9	448	526	974
10	517	1488	2005

*$Q = CLH^{3/2}$ $C = 2.63$ FROM BRATER & KING HANDBOOK OF HYDRAULICS, 6TH ED. CHAPTER 5.

1 SUPPORTED FLOW DOWNSTREAM, OR OUTLET CONTROL USED. TAILWATER ASSUMED TO BE AT ELEV OF CROWN OF CULVERT.

PROJECT	COMP. BY	JOB NO.
STORAGE VOLUME BETWEEN DAM & X-SECTION ①	BTB	20799 33
	CHK. BY JJD	DATE 1-8-80



AVE X-SECTION BETWEEN DAM & X-SECTION ①, L = 3800'

DEPTH	FLOW[1], CFS	FLOW AREA, FT²	STORAGE VOLUME AC-FT
4	500	105	9
5	1287	165	14
6	1908	243	21
7	2677	301	26
8	3584	370	32
9	4649	441	38

1 $Q = \frac{1.486}{n} A R^{2/3} S^{1/2}$

$S = \frac{100'}{0.7(5280)} = 0.027$

FROM CHOW, OPEN CHANNEL HYDRAULICS:

CHANNEL $n = 0.035$

OVERBANK $n = 0.08$

COMPOSITE $n = 0.08 \times 0.8 + 0.035 \times 0.2 = 0.07$

APPENDIX E

Information as Contained in National Inventory of Dams

INVENTORY OF DAMS IN THE UNITED STATES

NAME	LATITUDE (NORTH)	LONGITUDE (WEST)	REPORT DATE DAY MO YR
GREGG LAKE DAM	4302.5	7158.7	08JUL80

POPULAR NAME

NAME OF IMPOUNDMENT

GREGG LAKE

RIVER OR STREAM

NEAREST DOWNSTREAM CITY-TOWN-VILLAGE

DIST FROM DAM (MI)

POPULATION

ANTRIM

1

2150

TYPE OF DAM	YEAR COMPLETED	PURPOSES	STRUCTURAL HEIGHT	HYDRAULIC HEIGHT	NORMAL STORAGE	MAXIMUM STORAGE
EARTH	1900	S	4	4	1300	1400

DIST DAM FED R PRV/FED SCS A VER/DATE

SED N N N N

REMARKS

SPILLWAY WIDTH	SPILLWAY MAX DISCHARGE	POWER CAPACITY INSTALLED	POWER CAPACITY PRODUCED	NAVIGATION LOCKS LENGTH	NAVIGATION LOCKS WIDTH
24	60				

OWNER

ENGINEERING BY

CONSTRUCTION BY

REGULATORY AGENCY

CONSTRUCTION

OPERATION

MAINTENANCE

NH WATER RES BD

NH WATER RES BD

NH WATER RES BD

INSPECTION BY

INSPECTION DATE DAY MO YR

AUTHORITY FOR INSPECTION

PL 92-367

REMARKS

EARTH EMBANKMENTS

END

FILMED

8-85

DTIC